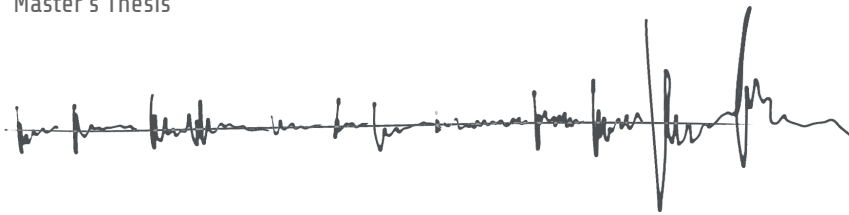


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NORMAL-ION.

A Procedural Reflection On Animation Audio

Master's Thesis



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Abstract

Procedural audio has gained the reputation of a valuable creative and functional resource within music and especially games territories during recent years, while its deeper exploitation has been rather limited and inconsistent. My research represents a plunge into the waves of the concept, in an attempt to explore and expand the rumors surrounding it. Starting from the premise that it could complement animation audio in a relevant way, I have structured my work into a reflective demonstration, which addresses both animated film and procedural audio fields at the same time. Thus, the four chapters constitute a guided observation, beginning from the root - procedural audio, what where and how it is - and ending with a demonstrative approach for my hypothesis, based on conclusions and findings revealed throughout the research. The in-depth study of sound effects resulted in finding significant connections between animation and procedural generation of sound, while the close examination of game animation and animated films, in parallel, drove several points in support for the proposition of a rather different sound design workflow, based on procedural audio generation. Hence, instead of trying to come up with new foley props, why not designing virtual ones?

<p>Keywords procedural audio, animation, animation audio, game audio, sound effects, sound design, generative, soundtrack, interactive, linear, nonlinear, fusion</p>
--

*to my parents, **Violeta & Traian***
for encouraging my adventures

(Special) **Thanks to:** *Paul Weir, Antti Ikonen, Jarkko Hyötyniemi, Can Uzer, Bokyung Kim, Leda Vaneva,
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INTRODUCTION

// This Is Not That



The aim of this thesis is to investigate the possibilities that procedural audio could open within the realm of linear applications, more specifically, animated movies.

Although the title suggests an approach to animation sound design, the work focuses on the comparison between animation used in linear and nonlinear ways, and is meant to propose procedural audio generation as an alternative for the traditional Foley. Therefore, games and game audio are referred to constantly throughout the research and represent an important part of it.

Aside from generative music and game audio, where its evident functionality has determined various attempts of exploration and usage, not much is known about procedural audio or its applications at the moment. Consequently, my initial and main purpose has been to inquire and understand what procedural audio is, within the current knowledge and practice boundaries. However, during the research, I have encountered a few interesting ideas and connections, which eventually lead me to the present approach. In order to clarify my point, I will provide a short background of this journey.

While trying to figure out what kind of application I could make that would put procedural audio at its best use, I realized the simple fact that game sound could be understood as the sound for the animations which form the game. Therefore, despite my own, consistent conclusions about the differences between sound design for games and sound design for film, I couldn't help noticing that the similarities between many levels in the audio design of both contexts could reveal interesting and creative perspectives.

Before proceeding with the structure presentation, I will mention the fact that, due to various aspects which have influenced the path of my research, I consider this approach a detective's point of view, and in a sense, procedural as well.

Hence, the thesis starts with a thorough attempt of defining and understanding the concept of procedural audio, forming the first chapter. Along with the findings

gathered in this unit, I am acknowledging that my analysis and, thus, writing, develop from the perspective of a sound designer and not an engineer or a programmer. Therefore, my idea is actively rooted in a technical field, but should not be confused with either the technical aspects of it or with the adjacent esthetic contexts. The separation is relevant for apprehending the connection with the further chapters and progress of the research.

The second chapter examines common methods of creating sound effects, emphasizing the artistic value of the craft. The parallel with the 'procedural' concept is questioned within the first subchapter, in an attempt to reveal a different perspective on sound creation. Moreover, 'sustainability' and 'industrial' matters concerning the SFX realm are inquired, connecting it with the rather logical and pragmatic regard referred to in detail within the first chapter. In addition, the 'Foley' practice is discussed, with a stress on the design aspects of creating sound effects, while the last subchapter highlights the influence of environment driven considerations upon the design and methods of SFX creation, by revealing other applications of sound effects aside from the visual territories.

Further on, the third chapter explores animation in both linear and nonlinear contexts, comparing games animation with animated films, in order to create a wider perspective on sound design within similar productions but with distinct purpose. While the chapter is mainly trying to answer the question of why animation would be the most appropriate field for audio innovation, it also calls attention to the influence of film on the way sound effects have been designed until these days, while proposing an inverted approach.

Finally, the last chapter shows a suggestion for applying the approach mentioned in the previous chapter, through a few examples of my own work, building up to a simple animation concept which would gather all the points together: 'Normal-Ion' (in Romanian, could translate as: Average-Joe).

In a rather different perspective, the structure of the thesis, as I pictured it, resembles a plant, which is also why I decided to use alternative titles for each of the four chapters. Consequently, the presentation could be summarized into a simpler version: 1. '//a few experiments that failed', where I discuss the starting

point of my idea, with a reference to the technical challenges involved in the attempt to generate procedural audio (Root); 2. '// an art in progress', where I extract the topic which connects to my interest as a sound designer and represents the prime matter in the progress of my research: crafting sound effects (Stem); 3. '// The Where the What', where I describe and justify my chosen ground for experimentation (Flower); 4. '// my reflection', where I reveal my own interpretation of the research and illustrate the concept (Fruit).

In conclusion, the thesis argues that the successful, known methods of creating sound effects for animation are necessarily the best ones. Although the technical aspects involved in such a process, at the moment, can make it difficult for an artist/ designer to embrace this approach, the thesis hopes to provide inspiration and perhaps motivation for further development of tools that would ease the access to procedural audio creation for sound designers from all spheres.

1. DEFINING PROCEDURAL AUDIO

// A Few Experiments That Failed



1.1. IN THE BEGINNING WAS THE WORD..

The term ‘procedural’, especially when related to audio, seems to be rather controversial. Therefore, I decided to start my research by leaving aside all the articles and discussions that recommend ‘procedural audio’ as a hot topic, and instead, taking a closer look at the linguistic roots of the term ‘procedural’.

1.1.1. Procedure

According to the Dictionary¹, a procedure is ‘an established or official way of doing something’, or ‘a series of actions conducted in a certain order or manner’. Another way of defining the same term would be ‘a series of steps followed in a regular definite order, such as a ‘legal procedure’ or a ‘surgical procedure’².

1.1.2. Procedural or ‘How To’

When thinking about ‘procedural’, things get a bit tangled, but, in simple words, the term stands for coming to a conclusion by following a set of steps. Thus, the ‘conclusion’ obtained from this kind of process can be considered procedural, but it is the conclusion’s attribute of content which gives meaning to the association. Therefore, a conclusion can stand for content, and this will be discussed in a later subchapter, when studying the two logic argumentation types: inductive and deductive.

Though, the focus is not the validity of the content, but the validity of the procedure, which means that the conclusion itself can be fake, as long as the procedure is right. The fascination with content/conclusions obtained in a procedural way is basically that anything and everything is possible, until or unless proved wrong. Magic, to start from.

¹Apple Dictionary

²“Procedure”. *Merriam-Webster*. Web. 15 Oct. 2016.

1.1.2.1. Procedural Writing

What is needed, what to do, what happened: ‘11 Experiments That Failed’ (Offill and Carpenter)³ is a cute procedural book for children, built around a little girl’s mind and introducing her experimental ideas, tested in a most serious and somehow ‘professional’ way. The book itself is not actually procedural, but its content is.

The delightfulness of the writing comes from an interesting combination of logic and absurdity, which makes the questions, or hypothesis, a real source of inspiration, if not more. The whole book translates into a rather lovely metaphor, showing how the craziest ideas could challenge the perfectly reasonable or ‘sane’ logic of an adult. Although the experiments are all prone to failure, as the title shows, the processes described seem to have interesting effects over a reader’s perception. Moreover, the findings are apparently ridiculously ordinary. For instance, to the hypothesis: ‘Ketchup and snow are the only food groups a child needs’, the deriving observations or conclusions have no direct relation with the initial statement, which is, at least in theory, supposed to be proven, but simply: ‘stomachache’, ‘brain freeze’, ‘lowe of ketchup wavering’. Therefore, they seem foolish, but very authentic, fresh and somehow new.

In that sense, the ‘procedural’ manner of dealing with things seems to radiate a strong illusion of power, trustworthiness, and, why not, discovery, as if shouting out loud: if the world is missing some guts, then it should just go procedural.

1.1.2.2. Police Procedurals

‘While traditional detective novels usually concentrate on a single crime, police procedurals frequently depict investigations into several unrelated crimes in a single story.’⁴

Whether it is about novels or tv series, police procedurals have been an inspiring topic in my attempt to explore and understand the term ‘procedural’. They refer to a type of narration, which is based on the procedure used by police to investigate

³Offill, Jenny and Nancy Carpenter. *11 Experiments That Failed*. 1st ed. New York: Scholastic, 2013. Print.

⁴“Police Procedural”. *En.wikipedia.org*. N.p., 2017. Web. 20 Oct. 2016.

crimes. Simply described, the pattern starts with tracing similarities from different cases, drawing hypotheses or potential conclusions related to the criminal mind, and proceeds with collecting evidence in order to prove it. Thus, the ending does not rely on finding out who the murderer is, but on having the intuitive knowledge turned into rational and consistent argumentation. In other words, once a criminal is ‘found’, usually very early in the story, detectives start building up the logic, which they use afterwards to prove their findings and to punish the culprit.

These procedures are usually easy to identify by concrete steps, such as: a detective visiting the crime scenes, collecting evidence, paying attention to different particularities that could signal the presence of a familiar mindset, and so on.

Moreover, police procedurals reveal the necessity of complex research, which involves diverse skills and even specialised help from different disciplines, by depicting a number of police-related topics such as forensics, autopsies, the gathering of evidence, the use of search warrants and interrogation.

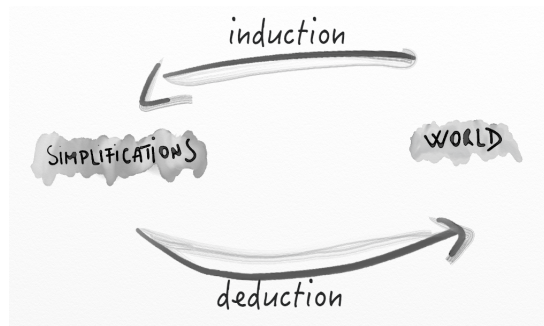
The relevance of this aspect will show especially in connection with a further subchapter, when dealing with procedural sound and physical modelling.

1.1.2.3. Procedural & Logic: How, Not Why

If we take the example of police procedures, we might think procedural is a term very much related to inductive logic. Since deduction stands more for algorithmic, it uses true facts to demonstrate that something else is true, or, in other words, solves a problem, starting from truths that have already been proved or categorized as such. Induction, on the other hand, uses intuition as the start of the process, ‘truths’ that have not been proved yet, visions. We could say that induction gathers evidence. The evidence is concrete and, in a sense, universally true as well, except it does not lead to a certain conclusion. It is the connection between evidence that might stand up for a clear ‘vision’. Thus, a vision cannot really be ‘solved’ or completely proved through evidence, but it can definitely be brought to light.

According to Apple Dictionary, the formal definition of logic induction would be ‘the inference of a general law from particular instances’ and often contrasted with deduction. In science, induction even used to be considered fraud, before it actually

revealed to be the actual vital method for research and innovation. The process of trial-error or failed experiments resulted from this method, has apparently been the key to progress, through history.



In many ways, the term ‘procedural’ seems to be related with the concept of ‘induction’. Procedures are not meant to determine something, they just stand for a logic of innovation, of open results. While researching for the current work, I have often encountered the feeling that procedural audio itself is by no means intended to offer a solution, or a fixed result. On the contrary, its purpose is to open possibilities, to display variety, flexibility, and, why not, some kind of controlled randomness. Simulating nature. Again, looking back at police procedurals, it seems mostly dirty, field work. Induction too, in contrast with deduction, which works with the abstract forms.

Mesmerizing, for the creative mind, perhaps boring for the anxious one. A puzzle, upside down.

1.2. PROCEDURAL AUDIO & RELATED: HOW I MET THE TERM

1.2.1. Understandings

It all started with an abbreviation I found while looking for some ‘hot’ topic to approach in an essay concerning the Games Now seminar, more than a year ago: PCG meaning Procedural content generation, used mostly when referring to games. According to Nicolas Fournel, the term means ‘generating content by computing functions’. The concept has started shining for various reasons, but my focus stays on mainly two of them: ‘when we need variations of the same asset’ and ‘when there is too much content to create’. Both will be detailed in further subchapters. Despite the apparent success promised within the PCG paradigm, after the first ‘round’ of research around the concept in audio realms, I encountered the following situation: ‘the hard truth is that while the idea is great in theory, no one knows what they’re doing in practice’ (Nair)⁵. Eventually, the author makes a point saying that the existing tools for generating procedural audio (such as: Supercollider, Pure Data, Max/MSP, Csound, Chuck, C/C++, etc) do not meet the needs of sound designers very well.

Thus, I understood that procedural audio could be a brilliant finding, but it is not yet meant for audio designers. Consequently, I confronted the following questions: who has the access and why exactly; and if procedurally generated content is not a mystery, then why is procedural audio still mysterious?

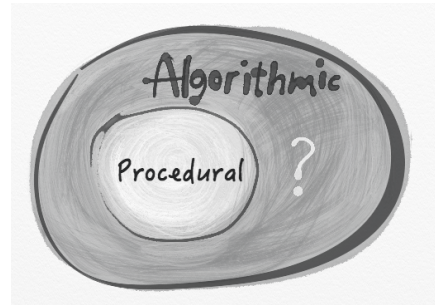
1.2.1.1. A Definition

According to Andy Farnell, ‘Procedural Audio is non-linear, often synthetic sound, created in real time according to a set of programmatic rules and live input’. This sentence is considered to be the official definition of procedural audio. Since I’ve been wondering a lot around the difference between ‘procedural’ and ‘algorithmic’, I think that, within this sentence, the separation between the two is quite vague, which makes the definition, at least for me, a bit confusing. Although it is not necessarily the algorithms that make ‘procedural audio’ procedural, but the ‘rules’

⁵Nair, Varun. "What'S The Deal With Procedural Game Audio?". *Designingsound.org*. N.p., 2014. Web. 12 Aug. 2016.

and the ‘input’, if procedural audio is ‘often synthetic’, we might as well understand that it is often quite algorithmic too.

Another definition, a bit more specific, closely related to this one, but very much game oriented, is: ‘the algorithmic approach to the creation of audio content, opposed to the current game audio production, where sound designers have to create and package static audio content’ (Veneri, Gros and Natkin 1)⁶.



As I will show in a later chapter, audio content is traditionally created through various methods and stored within audio files, programmed later to fit game events. These methods are quite flexible and usually rely on the creativity and experience of the sound designer. Although there are tools and processes involved in the workflow, the raw material for creating sound is recording, either of natural or synthetic sound.

1.2.1.2. Another Definition

According to Paul Weir, there is no clear definition for procedural audio, the term being used ‘too widely, rendering it meaningless’. Within this paradigm, he offers a few hints over what procedural audio could be, but not a definition per say.

One approach deals with the larger perspective: ‘Any form of sound creation where the source is different from the object it’s created for’ (Weir)⁷. Within this sentence, one can understand that almost any kind of processed audio can be considered procedural. Since it seems that the concept of ‘procedural audio’ is still in a state of ‘idea’, not yet grounded, it can easily be shifted in philosophy realms rather than practice. Thus, this definition makes perfect sense. Any creation requires procedures, in a way or another, and, whenever we think about sound for a specific

⁶ Veneri, Olivier, Stephane Gros, and Stephane Natkin. "Procedural Audio For Game Using GAF". 1. Web. 15 Sept. 2016.

⁷ Weir, Paul. "Paul Weir – Never Ending Music - Procedural Audio Now!". *Proceduralaudionow.com*. N.p., 2015. Web. 21 July 2015.

product, either film, games, or even music, sound will almost never be used raw. As I showed in the previous subchapters, many things can be procedural, since logic includes both induction and deduction, and logic stands at the core of (human) reasoning.

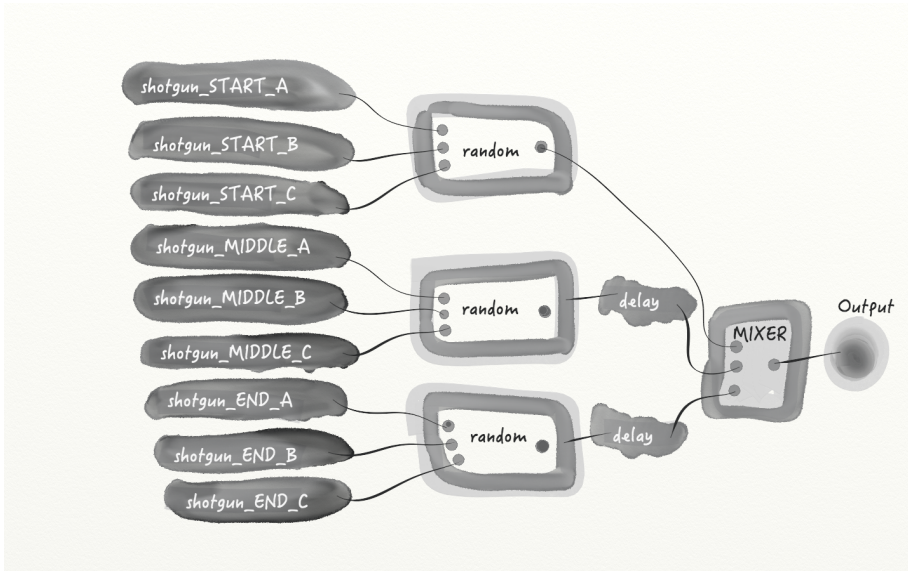


Fig. 1: 27 variations of the same sound in a game engine

The second approach to defining procedural audio which Paul Weir unravels, seems to deal with the very narrow perspective, ‘in games’: ‘Real-time sound creation that is closely linked into, and controlled by, systemic game mechanics’⁸. Narrowing the concept down to practice makes a very specific description, but also leads inevitably to correlating procedural audio with game audio. Since procedural sound has proved, until now, probably most valuable in its applicability within games, it is much easier to define or reveal its meaning through referring to games. This way of explaining the meaning of ‘procedural audio’ is so clear and exact, that it barely requires explanations, but, in my opinion, it is not necessarily the definition, but a good example of what procedural audio can be.

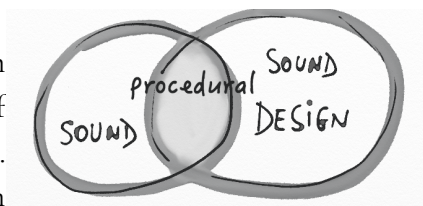
⁸Weir, op.cit.

1.2.1.3. My 'Detective' Take

In the process of understanding what procedural audio is, I noticed that the definition on its own is still quite mysterious, if not tricky. However, I did manage to extract a few clear facts, relevant for the purpose of my research. Apparently, the concept has gained recognition lately within the game realms, which made it, consequently, closely related to them, in the general perception. This could very well be one reason for most of the confusion arisen around it.

Although Andy Farnell offers a wide view over procedural audio, associating it with PCG and describing it more as a potential for many things, a more pragmatic perspective reveals how procedural audio can make a lot of sense. In this spirit, one would easily understand that, at least for the moment, when research and experiments haven't gone that far, the definition of procedural audio should be fairly correlated with game nomenclature.

On the other hand, a second relevant confusion comes from the border between the meaning of 'procedural audio' and 'procedural sound design'. Often used as simply 'procedural sound', the term



seems to be mistaken for either one or the other of the former mentioned. Thus, 'procedural sound' could refer to both, but the differences between them are quite important.

'This approach to sound design exists on a spectrum from procedural sound design, where we tend to be manipulating pre-existing assets, to procedural audio, a term more frequently used when systems of synthesis are used to generate the sounds themselves (with much in between that combine both approaches)'(Stevens)⁹.

In other words, procedural sound design requires procedural methods, but not necessarily procedural audio. As will be discussed in a later chapter, these methods

⁹Stevens, Richard. "Game Audio Implementation", quoted in: Andersen, Asbjørn. "Why Procedural Game Sound Design Is So Useful - Demonstrated In The Unreal Engine | A Sound Effect". *A Sound Effect*. N.p., 2016. Web. 19 July 2016.

can be powerful ways to achieve new and interesting audio content, except they still use audio files, as raw material, which is already contradicting the idea of creating audio from ‘chaos’, by using ‘methods’ only to order it into specific sounds. Although one might argue that audio files are also obtained out of a few processes, it is quite far fetched to call these processes methods, since there is no completely stereotypical way of ‘cooking’ a sound. This topic will be discussed more widely in a later chapter, dedicated to traditional sound design.

1.2.2. Misunderstandings. A Few More Definitions

1.2.2.1. Generative. Not(?)Industrial

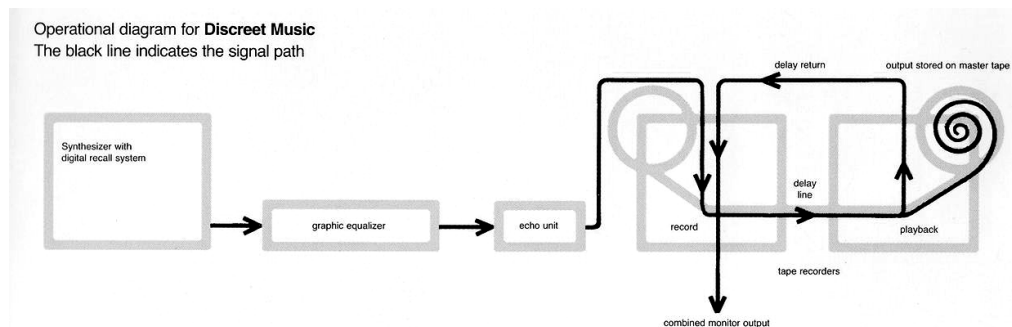
The term ‘generative’ is commonly used along with the word ‘art’, which is already a good reason to believe it has quite a complex and wide range of applicability and, thus, a vague or at least tricky definition. The purpose of this work is neither defining ‘generative’, nor ‘art’, but reaching for the borderlines of ‘procedural audio’.

According to Matt Pearson, generative art is rather a collaboration between an artist and a system, where the former provides instructions and the ‘initial conditions’ for the latter. The artist is not the one who gets his hands dirty with the ‘creation’ of the artwork, his task being closer to the one of a ‘curator’. Instead, the system is. In an ironical way, generative art could be nicknamed ‘industrial’, since the system is nothing but mechanically responding to the former’s vision/mind. Except it wouldn’t be very appropriate, since that could also be easily misinterpreted.

‘The common factor of generative artworks is the methodology of its own production, not the style of the end result’ (Pearson 4)¹⁰. So, when talking about generative art, the focus is not even necessarily the artwork in ‘flesh and bones’, but the process that made it happen. Moreover, it’s not even the tools that define it, but the way that they are used. Which brings us back to the artist. Because the artist is, after all, still the artist.

¹⁰Pearson, Matt. *Generative Art*. 1st ed. Shelter Island, N.Y: Manning, 2011. Print.

Generative art could be easily confused or misinterpreted, minding the set of rules and the system. Nobody talks about procedural art (yet), but about procedurally generated content or PCG, and, as a particular case, procedural audio. Matt Pearson eventually clears out the confusion, by stating that ‘there is nothing inherently generative about following orders’¹¹. In other words, the set of rules involved in both cases (when using ‘generative’ and ‘procedural’ terminology) has a different meaning for each. In the case of generative art, the rules represent only a part of the whole process, and they are presented under the name ‘methodology’. There are two leading principles in a generative methodology: autonomy and unpredictability. Whatever set of rules, they must provide that the artist kicks off an autonomous process and that the end product has a degree of unpredictability: ‘No two performances of the work are ever the same’¹².



.....Fig.
2: Brian Eno, 'Discreet Music', tape loop

Matt Pearson also points out the fact that generative methods can be used to produce various forms of art, from music to architecture, to poetry, dance or interactive experiences. ‘The autonomous system behind their creation may also be mechanical, games of chance, natural phenomena, or subconscious human behavior. Although not specified, sound art can easily be included in the list.

There are already a couple of hints over why ‘procedural’ is not to be confused with ‘generative’. Simplified, generative refers to something way larger than procedural, even though it includes a few similar concepts as procedural.

¹¹Pearson, op.cit, p. 6

¹²Ibid.

Just to mention a recent phenomenon of generative art gaining popularity in the realms of sound, I will stop shortly over generative music and generative music applications/websites. The inception of this burst appears to be Brian Eno's 1995 work with SSEYO Koan, when he also coined the term 'generative music', describing it as 'any music that is ever-different and changing, created by a system' (Eno)¹³. This seemed to have inspired the creation of many similar applications and websites, that offer the possibility to interact with such systems, either for recreation or meditation purpose, from Eno and Chilvers' 'Bloom', released in 2008 for iOS, to the brilliant audio-visual Patatap (online). The description of the former, as 'part instrument, part composition and part artwork', already reveals the process involved in its creation.

1.2.2.2. Adaptive. Artificially(?)Intelligent

Adaptive or dynamic are terms that basically refer to a relationship. Both describe communication between two or more 'parties' and involve concepts such as variables, parameters, call/response, action.

Thus, they don't come in contrast with either 'generative' or 'procedural', but should definitely not be confused with any of these two, since they represent attributes of an 'instance,' that might be generative, procedural, or none of them. Most commonly encountered in game terminology, but applicable to any kind of interactive product (not necessarily art), something adaptive is something that corresponds, in a way or another, to something else, which is usually in motion.

As an example, since it is very often found with reference to music and especially game music, the term can be used to describe a type of non-linear approach to music composition: 'Small pieces of music are put together to form a hyperstructure, and one of the challenges of composing dynamic game music is thus to get the events and processes of the music to fit the events and processes of the game'(Kaae, Collins 77)¹⁴

¹³"Generative Music & Brian Eno's GM1 With SSEYO Koan Software". *Interomorphic.com*. Web. 12 Nov. 2016.

¹⁴Jesper Kaae in: Collins, Karen. *From Pac-Man To Pop Music*. 1st ed. Ashgate, 2011. Print.

1.2.2.3. Procedural. Straight From Chaos

Within the previous subchapters, I discussed the term ‘procedural’ in general, and then I tried to find and understand the definition of ‘procedural audio’. The current subchapter will basically deal with questioning relations, consequently concluding the ‘understandings’ and somehow clearing up the ‘misunderstandings’.

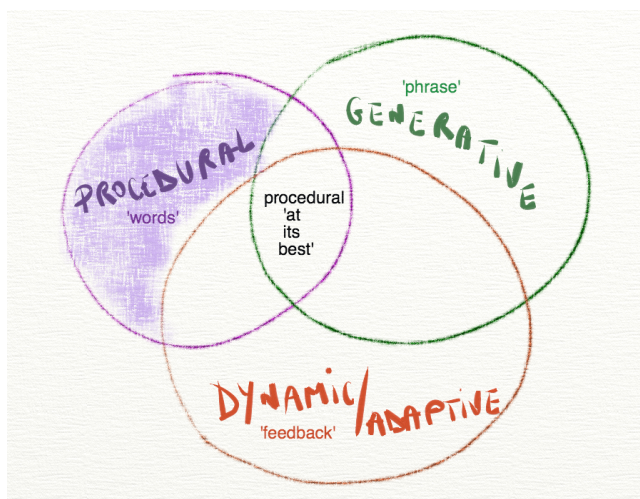
During the attempt to define ‘procedural audio’, the topic of this work, I noticed that it was correlations which stood behind a lot of misconceptions or confusions. Once these have been explored, I decided to search deeper into the meaning of procedural audio, by studying it in its current applications: music and games. My findings faced me with a set of new questions and confusions, which required understanding of two other terms, ‘generative’ and ‘adaptive’ or ‘dynamic’. My conclusion was that, in this sense, the key word is ‘relations’, which I will explain further.

Matt Pearson mentions the fact that both Stockhausen and Brian Eno had experimented with procedural methods of composition, where music was ‘defined by a set of rules or conditions’ (Pearson)¹⁵. This note is made, though, in the context of generative music, which led to serious inquiries about the borders between procedural and generative. Obviously, as discussed in chapter 1.2.2.1 (on the meaning of ‘generative’), procedural does not require a system, but a set of rules, which can be part of a system or not. Thus, I found it appropriate to compare the two within the relationship between words and a phrase, the latter corresponding to the term ‘generative’. To be more specific, words can be just words, but they only become a phrase if they make sense together.

On the other hand, looking into games and how procedural audio is interpreted there, I noticed a tendency to confuse procedural sound with adaptive or dynamic sound. Although not often mentioned as such, but mostly when referring to music in games, it seemed to fit very well the description of procedural sound design, if not just procedural audio. Again, I realized that procedural audio can easily be adaptive, since it is so responsive to parameters. Moreover, if I think of sound design, then I am already thinking about audio as something that is connected to a

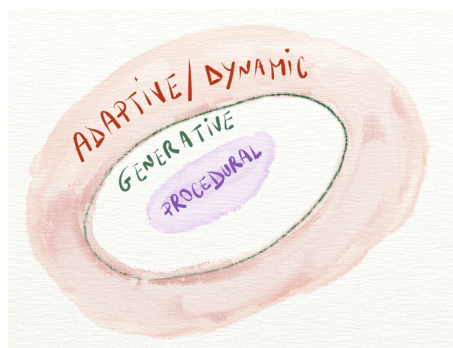
¹⁵Pearson, op.cit., p. 7

larger picture. Connection means, more or less, communication. In the case of procedural audio, once it is connected, through parameters, to a system, then it starts communicating with it, and is definitely adaptive/dynamic. Consequently, again, I end up finding a logical relation behind a terminology (mis)interpretation.



Procedural audio can be generative, and/or dynamic, but none of the two is really defining or setting its borders. The diagram above shows the logical relations in a simpler, visual point of view. The reason why I am emphasizing this fact is mostly because, while researching, I became interested in finding out what procedural audio could be, apart from those territories that have been explored. The purple area.

The next diagrams are details of the main diagram, through which I am going to explain some 'wheres and whys'.



'At its best a.k.a. a character whose feet make sounds' - the interference of all three terms is a particularly important case, because it basically reveals procedural audio in the best shaped context: procedural audio content, which is part of a system (generative property) that is controlled by an external entity (dynamic property). Used in both music and

games already, it is, nevertheless, a special, happy case, but not everything that procedural audio can be.

‘Modular a.k.a. some footsteps’ - Going from particular to general, the interference of procedural with generative only would strip the particular case described above of the context, so it could be compared with ‘Foley Art’. Except this time the ‘props’ would be simulated through procedures, while the artist itself would be replaced by a system that would generate variations from the initial ‘sound-object’, through a set of commands. Who and how sends the commands, can be a large and debatable cause, but this is just an example, or a ‘module’.



‘Procedural a.k.a. footprint’ - The third and most general case erases all contacts: no more senders or receivers, but not even a phrase: a word or, following the analogy above, a simple Foley Tool, somewhere, in a hook. The simpler, lesser determined, the more possibilities, though.

In conclusion, from understanding the misunderstandings, I managed to track down the mysterious piece of the puzzle: procedural audio outside of its containers. Although the connected terms helped for a more concrete description and, thus, a better clarification of the concept, I will proceed within my research, by trying to place procedural audio into different recipients than the ones already found, and observing what happens.

However, in order to proceed in that direction, it is necessary to look into the ‘hows’ and ‘whats’ related to current applications of procedural audio, as well as the sources of inspiration for the research that has already been done. The following subchapters will focus on those.

1.3. METHODS

One of the most striking observations I made when starting to read about the topic was the constant and relevant connection with computer graphics. Since this field has been far more investigated, it turned out to be, apart from a considerable source of frustration, also a valuable source of inspiration for audio enthusiasts.

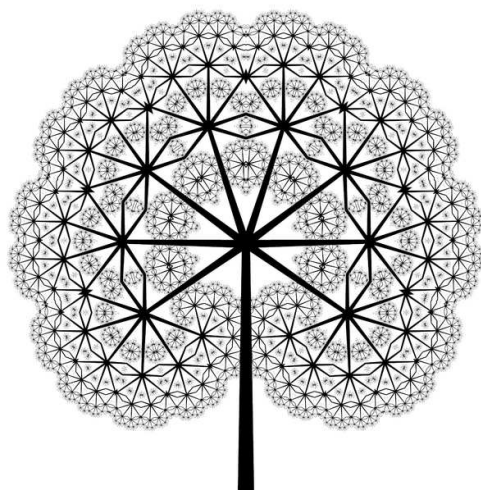


Fig. 3: Fractal Tree, by XIMONAU (www.rgbstock.com)

Thus, looking into computer graphics literature, we can find definitions of procedural methods as ‘algorithms to build representations of underlying phenomena’, such as, for example, marble color from math functions rather than scanned-in.

Although audio hasn’t reached far enough in terms of research to be literally compared with the visual field, there is at least one hint I could extract from studying the definition of procedural audio that could lead the connection into further extensions: the correlation with procedural methods. Not only the concept is much clearer, but it has also been proved useful in practice and documented more thoroughly.

Therefore, the next subchapters are dedicated to examining these procedural methods, in order to allow for a deeper understanding of procedural audio itself.

1.3.1. Data Driven Approaches. The Hybrids

There are methods that require audio data and methods that don't. Although some literature splits the methods into Top-down and Bottom-up, the latter standing for those methods that do not require audio data at all, I will be squeezing all the data driven methods into this subchapter.

1.3.1.1. Partial Re-synthesis

This method is described as a chain of actions, which starts with analysing data from an audio file and obtaining a synthesized model, subtracting it from the original file, and ends with summing the model back with the residual audio data. This way, the synthesised model can be manipulated, while the noise or the residual audio preserves its identity. Although I am not an engineer, I understand that this method represents the basis of most digital signal processing (DSP) effects and what it does, in more simple terms, is to allow variations of a sound, always returning an audio file.

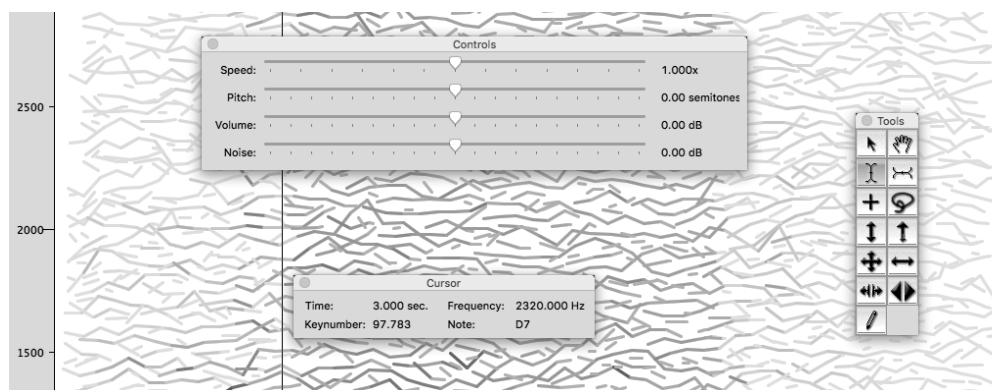


Fig. 4: *Spear*, Sinusoidal Partial Editing Analysis and Resynthesis software tool (klingsbeil.com)

1.3.1.2. Full Re-synthesis

The sound is reconstructed completely through synthesis, thus no residual audio data is used. The analysis stage still exists, but the process uses one or several different synthesis techniques, in comparison to the partial re-synthesis method.

This method allows the model to be highly parametric, thus, easy to manipulate without losing its identity. In the visual field, this is a lot similar to the vector graphics or images, which, although less popular than the bitmap ones, because of their reputation as less accurate when it comes to realistic ‘looks’, seem to have many ‘virtues’.

‘Vector images are made up of many individual, scalable objects. These objects are defined by mathematical equations, called Bezier Curves, rather than pixels, so they always render at the highest quality because they are device-independent.’ (Chastain)¹⁶

For instance, a vector image can be resized limitlessly without losing resolution. In a way, so does a full re-synthesized audio file, but, just as its visual brother, it might be questioned for its ‘realistic’ attributes.

1.3.1.3. Granular Synthesis

Although based on audio file analysis, granular synthesis does not work with synthesized models of the initial audio, but with small elements or ‘grains’ obtained from the sampled audio file. By playing those back in an almost limitless variety of combinations, one can get very interesting textures and even ‘sound effects’. Unfortunately, this method seems to be ‘under control’ in terms of use mostly for particular cases, such as car engine sounds or crowds, and mostly in games. My personal experiments with granular synthesis resulted in a lot of nice sounding ‘props’, but I must admit, quite random.

1.3.2. Physical Modeling

Also called Bottom-Up approach, by Andy Farnell, this method is particularly exciting, because ‘physical models allow us to describe the physical world in more or less precise ways, but they also provide us with conceptually direct ways of transforming the physical world in ways that are possible only in the virtual world’(Collins, Kapralos and Tessler 334-348)¹⁷. The same authors offer an exemplification in support of their comment, by referring to the music field, where

¹⁶Chastain, Sue. "Know The Difference Between Bitmap And Vector Graphics". *ThoughtCo*. N.p., 2016. Web. 2 Dec. 2016.

physical modeling has already been successfully tested: ‘physically based models provide performers with instruments that are physically rooted and thus interactive in intuitive ways’¹⁸.

Returning for a quick glimpse into digital graphics, it seems that various complex tools have already been created, in order to provide intuitive ways for CG artists to model their own characters or objects in a virtual environment. Although he/she starts from scratch, with only a sphere which is usually set to simulate a specific material, number of polygons etc, the artist only has to think about and give a new shape to the simulation of that sphere as if he/she would, in a physical or natural environment. Everything underneath that, the virtual tools, the materials, the way everything behaves in response to the user/artist’s input is designed by other artists, called ‘engineers’ and most probably with help from researchers in different other connected fields.



Fig. 5: snapshot from the film 2012

The concept of physical modeling in sound has a similar basis, but, at the moment, since the interest in it has not been proven high enough, the tools/virtual environments/engineers seem to be still quite absent from the picture. Therefore, sound ‘artists’ rarely get there, meaning that their pure skills are usually not enough

¹⁷Collins, Karen, Bill Kapralos, and Holly Tessler. *The Oxford Handbook Of Interactive Audio*. 1st ed. 2014. Print.

¹⁸Ibid.

to conquer the virtual world in order to reach their visions. Thus, they need to acquire multiple other skills and adapt to the general limitations or to their own.

For instance, if sound recording and video capturing would be compared, then it would mean that, until now, the main source for visual artists or film makers would have to limit to captured video. Although many things can be done with footage in post-processing, through using various effects, tracking, layering and so on, still none of the results obtained this way could compare with the ones where, in addition, there would be computer generated material composited into the frames: matte painting, CG models etc.

That is why, returning to sound realms, when artists do make it 'there', ready to get hands dirty with physical modeling, they understand that, as exciting as it seems, this method requires very complex knowledge of many disciplines, such as audio synthesis, mechanics (the authors of 'Oxford Handbook of interactive audio' mention a few types of relevant phenomena: collision, modal resonance, damped contact, stick-slip interaction, turbulent excitation), anatomy etc, and, nevertheless, thorough study of specific objects and materials, individually and in a given context. In other words, science.

'Interactions and complex gestures might be idealized as combinations of prototypical processes that are adapted to special cases. The sonic manifestation of any target object may be reduced to simpler basis actions.'¹⁹

According to the Oxford Handbook of Interactive Audio, an important aspect when starting out an adventure into creating procedural sound through physical modeling would be considering as many of the following objectives: informed deconstruction, identification of signature process, interactive object behavior, compactness, efficiency, sparse design goal, 'Good enough' design, plasticity of tools, contextual design, psychoacoustive and subjective dimensions, acoustic viability.

The real charm in such an adventure is that the complexity challenge is more or less easily overcome by the potential which could come out of the process. A bit of

¹⁹Collins, Kapralos and Tessler, op.cit., p. 334-348

science, a lot of technical knowledge, and, perhaps most of all, an imaginative vision, could make up for a handful of enthusiasm, just enough to bridge the way from a comfortable ‘just fine’ to brilliant.

In conclusion, to point out once again the particular importance of this method, I will recall its basic concept, which relies on the the fact that it does not just simulate something from reality, but it simulates nature itself: ‘the real interest of physical modeling is not so much how realistic it can be but how natural and expressive it is’.²⁰

1.3.3. Combinations

There are also suggestions of a combined approach. In short, this would mean generating data by using the physical modelling method and then applying the ‘data driven’ methods in order to generate variations or make it fit parameters (obviously, the latter is including the former). This way, there would be no more need for the traditional ‘asset acquisition, which would be turned into computation.

1.4. WITNESSED, FILED:

Current Applications Of Procedural Audio

1.4.1. In Some Games

In the beginnings, in the world of game audio, everything was created through synthesis. The progressive transitions that followed quickly, first to Midi based sound and music, then to Cd-Rom, afterwards to consoles supporting playback of CD-quality sound and so on, eventually lead to higher quality sampled based sounds. Consequently, most of the game audio is relying nowadays on high quality samples.

²⁰"AAS- Tech Talk - Physical Modeling". *Applied-acoustics.com*. Web. 15 Oct. 2016.

'We have arrived at a point where a quantity of music written for games (and otherwise) is created with a combination of samples, synthesis, procedural techniques, and sound modeling' (Kastbauer)²¹.

Despite this fact, recent rumors and debates around the utility of procedural sound in games, supported by a few examples of games actually using it, are slowly implying that going back to the roots and developing them might actually be the future of game audio.

The reasons which promote this concept among audio and especially game audio enthusiasts seem to be recurrent in articles and papers and refer to: repetition, reduced memory footprint²², and, most important perhaps, behavior-realism.

'Once you are confronted with a very cumbersome or repetitive task, you will naturally try to find ways to make your job easier' (Nicolas Fournel)²³. By generating sound effects procedurally, repetition seems easier to avoid: instead of, for instance, using a limited number of footsteps samples and playing them randomly, the computer could generate limitless footstep sounds in real time, according to set parameters.

However, as I stated above, the main argument in support of procedural audio within games seems to be best justified by the idea that the credibility and magic of game audio does not rely on the quality or realism of the sounds attached to events in the game world, but on the connection between the user's input, the visuals and the audio feedback. In other words, audio in games should 'simulate and manipulate parameters, mirroring reality, thus, it should be dynamic and in constant action-reaction to the variables happening on the gameplay and visual side of things'(Kastbauer)²⁴.

On the other hand, the short and timid history of its actual usage in games also reveals the fact that there have been some barriers in implementing the concept.

²¹Kastbauer, Damian. "Audio Implementation Greats #8: Procedural Audio Now". *Designingsound.org*. N.p., 2010. Web. 15 May 2016.

²²the amount of main memory that a program uses or references while running, "Memory Footprint". *En.wikipedia.org*. Web. 15 Nov. 2016.

²³Nair, op.cit.

²⁴Kastbauer, op.cit.

Concerning the disadvantages found by researchers and practitioners, it all comes down to a couple of reasonable doubts. First of all, physical modeling seems to consume a lot of CPU, which, in games, is shared with the usually prioritized visuals and mechanics.

Secondly, there seems to be a significant lack of tools, which Nicolas Fournel explains: ‘Having a model running in a tool does not mean that you are ready for production!’(Nicolas Fournel)²⁵, meaning that although there have been attempts of prototyping, few people/organizations truly bothered to figure out ways of turning procedural sound into more than inspiration and put effort in making it viable within the game production workflow. His relevant comment explains the situation from even a larger perspective: ‘Historically, tools in the game industry have been built more to package assets in a convenient way or to help organize data in scenes or levels, rather than to empower the artist and help him create something truly adapted to an interactive media.’²⁶

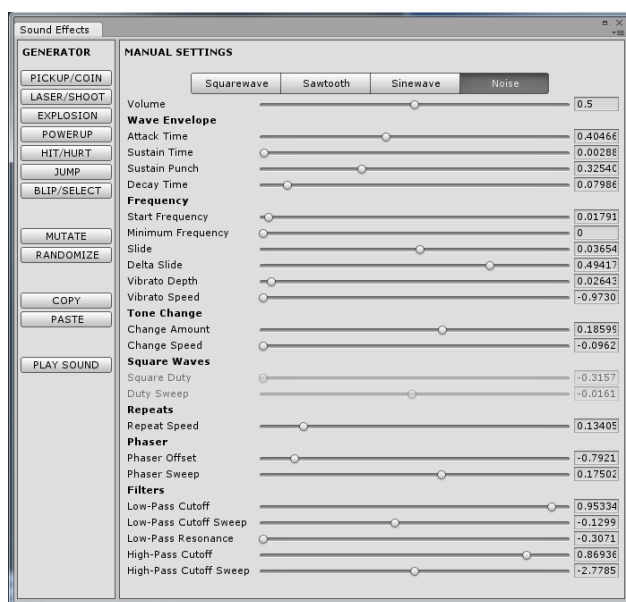


Fig. 6: *usfxr* - Procedural Sound Effects for Unity, plugin

Last but not least, that which stood in the way of most attempts, seems to be, in the end, the focus of game developers and programmers. As Mads Lykke explains, for

²⁵Kastbauer, op.cit.

²⁶Ibid.

many years already, people who owned the weight in decisions related to game workflows have embraced the inertia of trying to ‘achieve the most realistic games possible with the present hardware’, thus basically denying any chance of development or change: ‘This focus has led to today’s paradox where sample-based audio is the auditive counterpart to the highly detailed modeled computer graphics’(Mads Lykke)²⁷.

Consequently, procedural audio in games has been occurring quite rarely, and, mostly, within very limited frames. While potential has been seen through by practitioners in many ways, such as: physical modeling, with 3D objects, that offer sonic information through size, shape, surface motion interaction etc, engines, vehicles, animals, environmental and ecological sounds, only a few cases actually showed interest and effort in making them real assets. Among those, there is the ‘crowds of dialogue’ example, from *Insomniac*, where audio snippets are basically combined as a ‘walla’, which is modeled through parameters like density over time and volumetric dispersion over space²⁸, controlled by gameplay, in order to offer a increased perception of scene dialogue and action.

Among the companies who have worked with procedural sound, research also mentions Disney, EA, Eidos. However, there are at least two groundbreaking examples of games that have used procedural audio daringly: *Spore*, released in 2008 and, a more recent one, *No Man’s Sky*, released in 2016.

The former uses a procedural music system, co-developed by Brian Eno. Almost in the spirit of a cute comedy show, the music seems to behave according to the player’s style: ‘the system takes variables from user input and uses mathematical algorithms to create control data which subtly changes certain aspects of gameplay, thus enriching the player's experience’ (Donnellan)²⁹. Since the game develops through five stages of evolution, each of them uses separate parameters to manipulate the music. For instance, the instrumentation and themes are already responding instantly to the player’s editing choices for the creature or spaceship.

²⁷Kastbauer, op.cit.

²⁸David Thall in Kastbauer, op.cit.

²⁹Donnellan, Liam. "Non-Repetitive Design: *Spore's* Procedural Music System". *Smigiamd.blogspot.fi*. N.p., 2010. Web. 16 May 2016.

On the other hand, the latter uses rather generative music, which plays the role of an ambient soundtrack and not exactly interact with the player. Instead, since the visual content within the game is procedurally generated, most of the sound effects are procedural as well. Audio Director Paul Weir explains how elements such as the noises of the creatures in the game world are generated from scratch, through plugins designed to model these sounds, fitting specific parameters, such as a creature's neck length or mood. His justification shows up very clear, in this context: 'From a sound design perspective, that's really difficult to handle because of a number of questions: how many different types of creature are there going to be, how do we map that onto recordings, and how do we even make those recordings?' (Paul Weir)³⁰.

1.4.2. Mostly Music

The 'Spore' example is not an accidental choice. It seems that the confusion between procedural and generative or algorithmic music³¹ is quite persistent in literature and in the general understanding of terms. While many games developed after Spore's release and most probably inspired by it include generative music, not all of them use actual procedural music, but rather deal with procedural systems of playback. The music itself is often based on samples. One nice example could be the award winning Proteus. Since the playback system is algorithmic, it allows for endless possibilities of listening according to specific instructions that communicate between the game and the music system. Thus, it is not uncommon to find articles mentioning the uniqueness of the soundtrack experienced each time the game is played. Even Karen Collins³² mixes up the terms, referring to generative or adaptive music as procedural.

However, in the history of games, applications and even interactive sites, it is far more common to encounter examples where there actual procedural music is involved, rather than other types of procedural audio. Nowadays there are countless similar applications which can even be used as musical instruments. Some papers have been studying the phenomena, but that is a wider discussion, hinting

³⁰Diver, Mike. "'No Man'S Sky' Sounds Amazing, Literally - VICE". *Vice*. N.p., 2015. Web. 21 Oct. 2016.

³¹Andersen, op.cit.

³²Collins, Karen. "An Introduction To Procedural Music In Video Games". *Contemporary Music Review* 28.1 (2009): 5-15. Web. 6 Nov. 2016.

somewhere further away from the current paper's target. The important consequence of these findings is understanding that somehow the idea of procedural audio captured interest in the musical realm, thus leading to massive research and showing quite amazing results.

If procedural audio made a point somewhere already, that place seems to be the music field. Considering either the hundreds of existing music-making apps, such as Figure, Scape, Polyforge, Jasuto, or different music systems, meant for performance or within installations, the obvious fact revealed is that 'believers' and experts from various backgrounds, ranging from composers and performers to physicists, computer scientists and so on, seem to have experimented, collaborated and eventually coined: it works and it's worth.

'Overall, compared to any other synthesis methods, physical modeling is the only one which can recreate the richness, liveliness and complexity of natural sounds but also the only one that can reproduce the interactive feeling associated with playing a real acoustic instrument'(Marc-Pierre)³³.

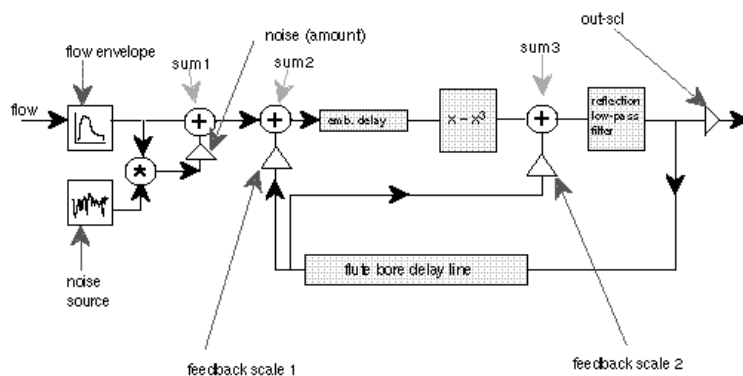


Fig. 7: Perry Cook's Slide Flute: A Simple Flute Physical Model

There are several papers and articles describing the stages and possibilities discovered in order to emulate existing musical instruments and establish ground for creating new ones. In his work exploring the history of digital sound synthesis, Chris Chafe includes an inspiring quote dated back in 1959: 'Apart from its potential contribution to the structure of a composition, the principle feature of

³³"AAS- Tech Talk - Physical Modeling". *Applied-acoustics.com*. Web. 21 Nov. 2016.

digital computer generation of music is its precise control of frequency, timbre, temporal sequencing within a single voice line, and temporal sequencing of multiple voices'(Chafe)³⁴. The means to make things possible were not available at that time, due to obvious lack of technological resources, but the potential had already been spotted. Later on, technology evolved too, and I would think that this idea, among others that occurred in parallel or as chain reactions, was one of the main drives of the whole process that brought things where they are today.

1.4.3. Plugins:

The Virtual Tool Or Art At Its Core

When it comes to plug-ins, we can find quite a lot of examples where procedural audio has found its way. As mediator tools, plugins come in different shapes and for different purposes. Mostly encountered in music production and developed to work within digital audio workstations, they are split into three main categories: instruments, effects and midi effects. All virtual, or, in other words, software simulations of hardware, based on technologies that deal with digital signal processing.

Emulating the look and sonic characteristics of hardware synthesizers and samplers, the first category clearly reveals the main purpose of research and development for these tools: recreation of famous equipment, resulting in a much cheaper and accessible alternative.

Simply put, while virtual instruments generate audio, virtual effects process audio and midi effects process midi messages. Basically, the way they work differentiates them, but, at the core, they are all defined by a complex bunch of procedures, meaning to turn heavy, costly material into light-weighted, 'virtual' versions, with similar utility. Alchemy.

Apart from the wide variety of instruments created as accurate copies for already existing gear, the constant development of plugins resulted in many innovative techniques and solutions, thus bringing up original - sounding, behaving and looking - instruments. Although most of the sound-generating plugins refer to

³⁴Chafe, Chris. "A Short History Of Digital Sound Synthesis By Composers In The U.S.A.". Web. 5 Dec. 2016.

music and are based on methods relying on a subtractive analogue architecture similar to the traditional manufactured synths, there are new approaches also. One popular example, that uses physical modeling and includes granular synthesis capabilities, is Kaivo.

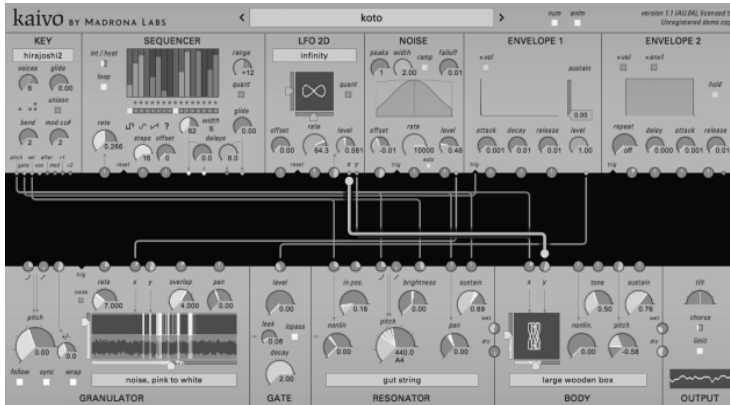


Fig. 8: Madrona Labs Kaivo

‘[...] even if all you do is load a preset and start adjusting parameters at random, you soon find yourself in a strange, otherworldly territory where common sounds start to degrade and dissolve into unique timbres’³⁵.

As described in a previous subchapter, the physical modelling approach not only gives a very accurate sense of a real instrument, but also unravels a highly **creative** sandbox, if, for instance, the modelled sound would be replaced with an audio sample and ‘played’ through the same parameters used to shape the originally intended instrument. The results can be mind blowing, turning the virtual instrument into a real sound/ Foley/ ‘you name it’- audio tool.

Moreover, plugins seem to have gained interest in the game audio realm as well. The raising popularity of audio middleware attracted the opportunity for hosting virtual tools, in a similar way DAWs do. Two of the most popular middleware solutions, Fmod and Wwise, allow for plugins and effects. Although much less versatile, there are also a few plug-ins for procedural audio: SoundSeed, for Wwise and the audioGaming bundle, designed for Fmod.

³⁵"Ten Of The Best: New Synth Plugins - Attack Magazine". *Attack Magazine*. N.p., 2015. Web. 16 Mar. 2017.

While the former relies on an air model, from which the user can generate wind and ‘whooshy’ sounds, by tweaking a few parameters, the audioGaming set can generate fire, weather and gesture sounds, through a similar approach. Although the synthetic models offered through the plug-ins mentioned are still quite modest, at least in terms of diversity and freedom of manipulation, they seem to be of great help within game audio design, substituting for a lot of unnecessary effort from the audio team. Thus, very practical, but not yet creative: a start, nevertheless.

2. SOUND EFFECTS

// An Art in Progress



2.1. SFX

SFX is an abbreviation for Sound Effects, a term rooted in the early 30s, along with the rise of the golden age of radio. Most commonly understood as any or all the effects created in order to imitate real sounds while enhancing the illusion of reality within a production, they are separated from dialogue or voices and music.

2.1.1. A Relevant Introduction

Sound effects were initially created to support radio shows and plays, revolutionizing the world of media. The impact of sound on audiences was perhaps best proven through Orson Welles' 1938 broadcast, 'The War of the Worlds', which, although completely fictional, managed to worry a considerable amount of people, and, thus, become legendary.

Because stories had to be told without any help from visual sources, effects occurred first as aural cues, supporting the perception and understanding of actions or the passing of time throughout the narration, without the continuous presence of an actual narrator. Consequently, sound received the chance to prove itself a narrator, while sound effects gained attention and respect on their own, as a distinct and important element, apart from what voices used to represent. Later on, the movies started retrieving this attribute as well, along with letting go of sound as only background or mood component and turning from music to what radio had discovered and enhanced.

The golden age of radio was also the time when the search for 'the right sounds and the machines to produce them' (Lizowski)³⁶ had started. Already by that time, the need for automating the creation of the more 'common' effects had arisen, thus creativity expanded into building different kinds of sound effect generators. The most sophisticated were the rain machines, while the simpler were miniature

³⁶Lizowski, James. "History Of Sound Effects". *Omni.media*. N.p., 2016. Web. 18 Nov. 2016.

versions of the real mechanisms, such as doors and windows, and were called ‘manuals’.

2.1.2. The Making Of

The creation of sound effects is quite a relative process, meaning that, throughout history and, depending on the kind of effects and their purpose within the final product, actors, artists, recordists and sound designers have been constantly experimenting, while sound theorists have been trying to organize the findings into different criteria, in order to provide guidance and ease the task of the creators.

Despite a variety of suggested workflows achieved already, the ‘making of’ sound effects is still on large scale considered quite flexible and more an improvisational process than a technical one. The ratio between creativity and discipline is a tremendously interesting topic though, which is why it will be discussed more thoroughly through the next subchapters.

Although, for the purpose of the present work, sound effects will be addressed from a rather general perspective, and not just by relating to the orientations or practices they have been involved in, it is as well relevant as it is important to mention an objective classification, derived from their use in media so far.

Thus, according to the Sound Effects Bible (Viers 5)³⁷, there are five main types of sound effects: Hard Effects, Foley SFX, Background Effects, Electronic Effects/Production Elements and Sound Design Effects. Rooted in film sound production, this classification is particularly appropriate, mainly because of the complexity of functions addressed. However, the separation between the categories stated above is not necessary in all the cases, but, somehow, referring to sound effects is easier when imagining them functioning within a larger, more complete scheme, either attached to visuals or storylines, or both.

³⁷Viers, Ric. *The Sound Effects Bible*. 1st ed. Studio City, CA: Michael Wiese Productions, 2008. Print.

2.1.2.1. Procedures So To Speak

‘ There’s no excuse for having a mental or creative block in sound. You can just go out and collect things in the real world - they make the sound, not you’ (Gary Rydstrom)³⁸.

Creating sound effects often appears to be an open playground. Although a simple search on the internet will show quite a lot of forum posts, articles, youtube videos and references to books that offer tips and tutorials for various types of sounds, they all tend to work rather as inspiration sources. Therefore, a sound designer looks more like a magician on the field, encouraged to try out, modify, invent and eventually share. There is no doubt that improvising sound effects would be less than art and craft, but the correlation with magic actually reveals an important aspect of it, which can be easily overlooked. While a magician’s purpose is to deceive, he needs very clear planning and a lot of practice, and so does a sound designer.

Despite the many of possibilities of ‘cooking’ sound effects, every recipe follows two main steps. First, there is the recording stage, which can take place in a professional studio, outdoors, or in any kind of environment which drives inspiration. The second stage is basically editing and processing the recorded material, which might also involve layering with other recordings, in such way that the resulted sound would be an accurate replica of the artist’s imagined or intended sound. Each of the two parts usually contains other subordinate stages and actions, depending on a variety of factors, such as: the type (genre even, if we are talking about a movie) of the product where the sound effect will be used or the role of the sound effect (storytelling, animation, musical, indicative or adaptive)³⁹. Moreover, the recording stage might call for one or more actors, two or more specific environments and several different props, while the processing stage could need a couple of distinct recordings and tracks, with different sets of effects for each, and another set for the overall mix. On top of everything, the designer’s time, creativity, tools and so on will also determine the sequence of things to do for creating a sound effect.

³⁸Sonnenschein, David. *Sound Design - The Expressive Power Of Music, Voice And Sound Effects In Cinema*. 1st ed. Michael Wiese Productions, 2002. Print.

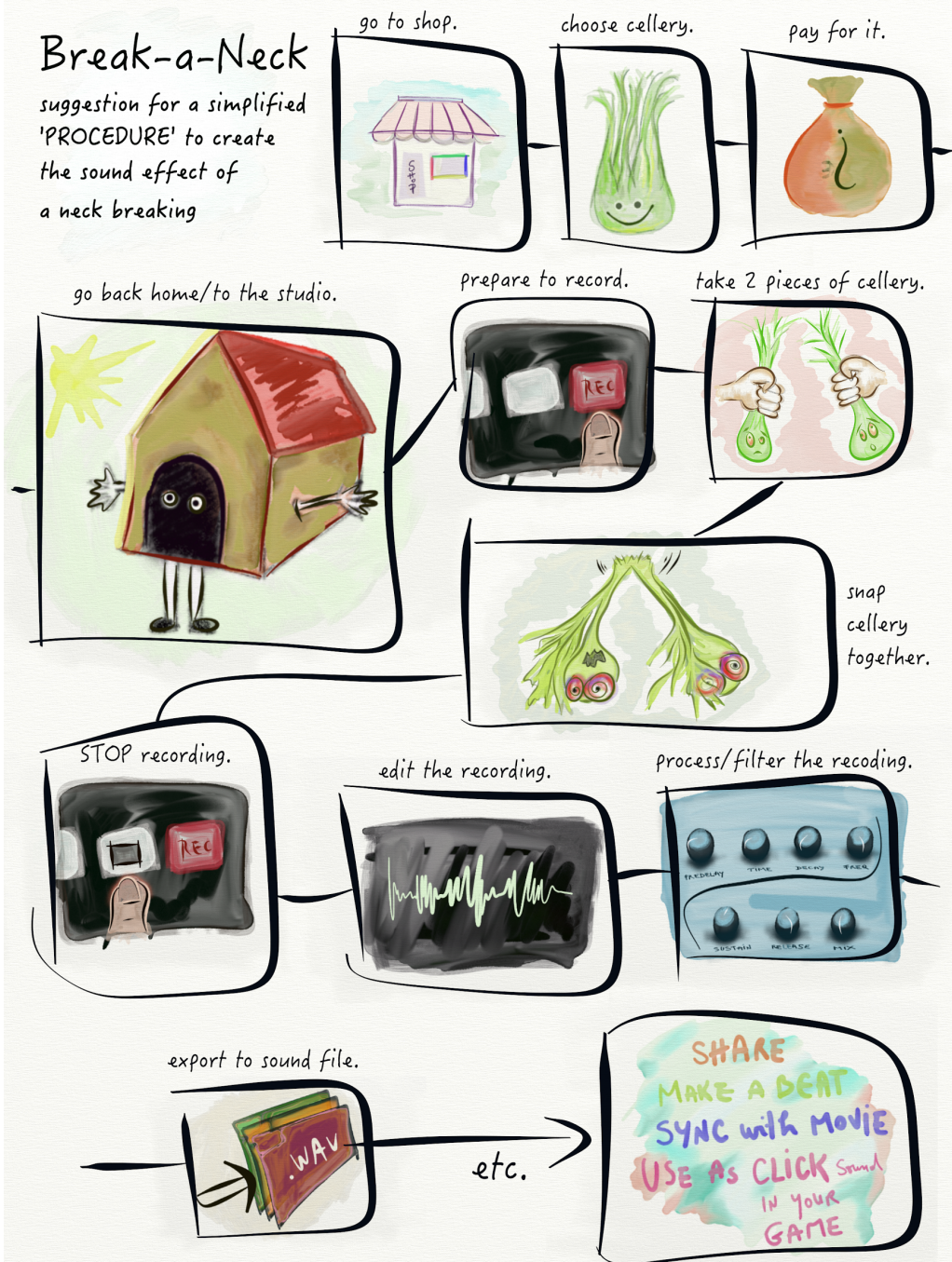
³⁹Theme Ament, Vanessa. *The Foley Grail*. 1st ed. Hoboken: Taylor and Francis, 2014. Print.

The process can easily be broken into a logical sequence of steps, which brings up the idea that creating a sound effect could be, after all, similar to following a set of procedures. The way sound effects have been made so far, though, shows that a purely logical approach would not serve almost at all, mainly because of its inconsistency. The multitude of influential factors would lead to a way too complicated algorithm. On the other hand, this exercise makes it somehow clear that there is a certain relationship between procedures and SFX creation, which could be used further. Nevertheless, the need to automate certain parts of the process has already become obvious, through previous attempts of either categorise sound effects or even build devices that would generate particular types of sounds.

Returning to the history and practice point of view, sound effects seem to have three main sources: field recordings, Foley recordings and sound libraries. While the first type usually refers to movies' production stage, it can consist of any recording which captures sounds in a natural environment, either from actors, environment or the sound recordist himself. The Foley sounds are also derived from the film workflow, where they represent one of the post-production stages. Although they were born from the need to make the subtle sounds, neglected or avoided during the shootings, more audible, they refer to any kind of sound effect recorded in a Foley room, away from its natural source, thus, fake. Finally, the sound libraries represent yet another proof of the need to automate the creation of sound effects. If quality ingredients make a great start for a chef, then so it goes with these collections of base-sounds and the sound designer. Many times, though, during the creation of a sound effect, all three sources might be used.

Break-a-Neck

suggestion for a simplified
'PROCEDURE' to create
the sound effect of
a neck breaking



2.1.2.2. Questioning the Creator: 'Industrial' SFX

I was mentioning previously about the need for automation of specific tasks within the creation process, which had occurred already in the 30s and 40s. Thus, not only were sound effects already involving repetitive tasks, but the demand for similar sounds was increasing in many productions, facing sound 'designers' with the challenge of either using an already existing sound effect many times or having to record the same kind of effect over and over. Because sound was already acknowledged as an individual and powerful asset, the former option was obviously not sustainable. On the other hand, the latter involved time and effort for a very modest feeling of fulfillment from an artist, therefore, not sustainable either. Thus, the idea of industrial sound effects started to make sense, and the interest for building devices arose along with it.

The so-called common effects, such as the weather related ones, were among the first to start with. Inventivity went so far, that, eventually, the actual object resembled almost nothing of its purpose. Rain machines, for instance, had become quite sophisticated and familiar in many studios. One example of some of the latest models resided in a box, and its mechanism consisted of a hopper filled with bird seeds, which would pour over a turntable on the bottom of the box. The motor which spun the turntable could be adjusted to various speeds, giving the illusion that the rain is more or less heavy, while the turntable itself could be 'tuned' with different types of material, such as tin, parchment, or wrapping paper, enhancing the illusive variety of surfaces the 'rain' would fall on.

The reasons why this kind of approach to recreating the sound of rain are quite many and, in this scenario, ridiculously obvious. Apart from saving a lot of time, because there would be no more specific dependencies, such as having to wait for the real rain, leaving the studio, or even moving from a place to another to get different perspectives of the sound, it would also require less physical effort, leaving more for the creative side.

Another example of the early attempts of industrializing sound effects creation would be the 'manuals'. These devices, built specifically to help simulate common actions used in stories, involved the recreation, in small scale, of random objects,

such as doors and windows. The logic of this practice was based on narrowing these objects down to the mechanisms which make them generate the desired, familiar sound. Once again, the sound designer would be spared of switching places or having to deal with secondary tasks in order to record generic sounds.

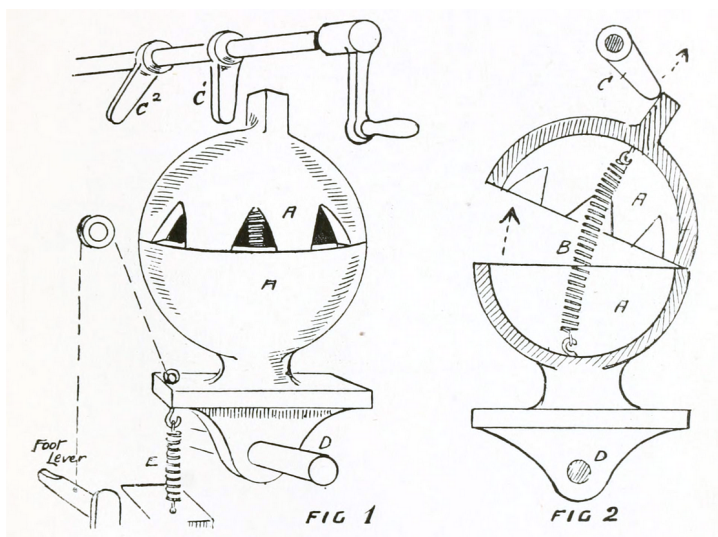


Fig. 9: Van Dyke Browne's horse trotting machine (*Secrets of Scene Painting and Stage Effects* , 1900)

In this perspective, thus, the use of adjacent machines for creating sound effects doesn't seem to affect the art itself, but rather enhance it. As I will move on to Foley effects, the relationship between art and designing sound effects will be studied in more detail.

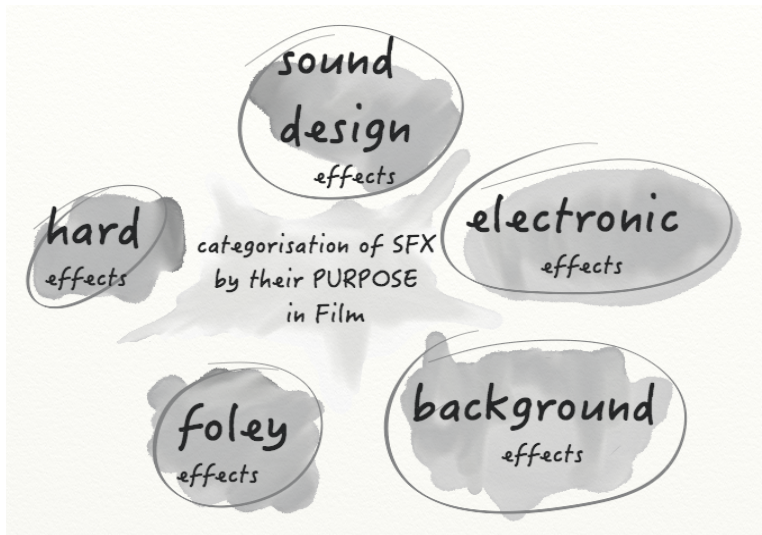
What seems interesting for now, aside from reinforcing the fact that 'logic' and creativity seem to be supporting each other within the process of creating SFX, is that, although these early experiments have ceased to develop, the concept is still alive and kicking in various shapes throughout studios even nowadays.

2.1.3. Where Exactly

‘ Sound effects build character to a spaceship the size of Delaware that is, in fact, the size of a skateboard’ (Theme Ament)⁴⁰.

While discussing about how SFX are made, in the previous subchapter, I referred to the fact that there are many factors which determine how the process will flow, and one of the main is the final product for which the effect is created. Just to list a few of the most specific such artefacts, they would be: radio productions, theater plays, movies, games, apps, audio-visual installations and, nevertheless, music.

Thus, it would be easy to refer to sound effects by using the classification mentioned in the same subchapter. While the movies use all five types, each of them can have more or less a role in either of the other fields.



For instance, hard effects refer to the very generic sounds, such as car horns or gunshots, which can simply be recorded and used over almost any kind of video, app, installation and so on, which involves the action in question or a reference to it. Their connection with the product they would be engaged in is rather utilitarian, so, in a rough way, their designing process could be narrowed down to a few basic steps, according to the corresponding theme.

⁴⁰Theme Ament, V., op.cit., p.3

In a similar way, the background effects, which have to do mostly with ambiental, continuous, sounds, can also find their place in certain kinds of apps, installations, and, of course, games. The purpose they might serve could be mood, a feeling of space or continuity, and so on, thus, once again, the ways to create them would use a roughly similar track: finding an environment or a few, recording long takes, editing them together, perhaps adding one or more particular hard effects to enhance particularities of the space with specific panning or reverbs, and, in the end stage, eventually creating a loop to fit the required timing.

The electronic effects or production elements, mainly associated with trailers and science fiction movies, work very well within specific game genres, apps, installations and even electronic music. The sounds belonging to this category are described as ‘metaphorical in nature and purely subjective in their use’ (Theme Ament)⁴¹ and were originally based on synthesizers and keyboards. Even though nowadays recordings are also used as a main source, the process of creating the final SFX requires a lot of DAW plug-ins and filtering.

On the other hand, when it comes to Foley effects, the correlation with a visual element is always the core part of the creation process, since their main purpose is to sync and blend. They also call for performance, which somehow binds them to the specific product they are made for, but also gives them uniqueness. Having been born in film production, they are most often related to footsteps, clothes movements and impacts, but their general role is to enhance different sounds, building over realism: metaphors, moods, motifs etc. However, either based on a Foley technique only or combined with it, many if not most of the sound effects created for commodities, other than film, could easily be part of this category.

Last but not least, the fifth category stands for ‘sound design effects’, referring to those effects that are impossible to record naturally, thus, relying on a DAW and heavy processing. They are not just enhancing, but creating reality. For an animation or a game, it would be, perhaps, easiest to consider all sound effects as being part of this category.

⁴¹Theme Ament, V., op.cit., p.6

All in all, the importance of these categories resides in the fact that they hint towards the flow of the creation process. Comprehending the relationship with other elements and the relationship with reality represents the very first step in understanding the purpose of the sound effect and picturing it, before even deciding how to create it.

2.1.4. Sustainability: Hysterical Wilhelm

Indeed, ‘a sound effect can be defined as any sound recorded or performed live for the purpose of simulating a sound of a story or event’. What is less talked about when defining SFX, is their great ability to be recycled. Once you create a sound effect for a specific purpose, it is even handier to rethink it in a new context, reuse it or start building on top of it, in order to redirection it.

There are many examples of sound effects used over and over, as they are, especially in commercials. On the other hand, sometimes, the intentional reuse of a popular sound effect can generate relevance on its own, the same way intertextuality adds meaning to written works.

One such example is the famous Wilhelm scream, originally created for the 1950s movie ‘Distant Drums’ and corresponding to the sound of a character who is eaten by an alligator. The same effect has been used at least a hundred times more ever since, in films such as: Star Wars, Indiana Jones, Poltergeist, Toy Story, King Kong, etc., turning it into an icon. Moreover, films continue to reuse it even nowadays, as a tribute for being the most recognized scream in cinema. Its initial purpose has definitely shifted form, but this fact only reinforces the particularity and strength of recycling sound effects.

2.2. FOLEY

2.2.1. Myth and What Else

Although it is commonly assumed that the ‘Foley’ effects were named after their pioneer, Jack Foley was not the first one to do the craft, and he was definitely not a sound designer. Sound effects started shaping up along with radio shows and plays, and first rather as ‘lighting gags and dramatic effects with the drum set’ (Theme Ament)⁴², inspired from the vaudeville shows. Bob Mott, a previous drummer educated in screenwriting, had already started using different props to make sounds for radio and television, by the time Jack Foley initiated his own experiments and became successful as a ‘soundman’. Neither of them was a Foley artist, since the concept only became clear later on, after sound design became recognized as a standalone necessity and craft, itself.

‘Because of his particular talents including serving as a director, actor, writer, cartoonist, baseball player, and stuntman, he was the person who had the perspective to develop this job, which was invented out of necessity, into an esteemed craft that later was enhanced and perfected by others into a nuanced and respected field of sound effects with its own name, in honor of him’ (Theme Ament)⁴³.

What is particular, in order to understand the definition of foley art, is the fact that, at the time it was invented, there were no effective methods of recording, thus not much to say about sound editing either. The first movies to use sound effects were basically using one track of effects which had been performed and recorded in one take, perfectly synced with the picture. Thus, the keywords to describe what Foley is, would be performance and intuition, rather than audio skills or training.

Very similar to the dialogue re-recording, foley art is a part of the filmmaking process and happens in the post-production stage. Foley artists ‘perform’ the sounds that have already been recorded or that haven’t been recorded at all, depending on whether those sounds are meant to be enhanced or they are meant to build. Either

⁴²Theme Ament, V., op.cit., p.9

⁴³Theme Ament, V., op.cit., p.7

way, the art itself is meant to support the ‘reality’ feel of the movie, which can range from realistic to fantastic, since reality in film is quite relative. More about the various ways in which foley effects work will be discussed in the next subchapter.

Although its definition is strongly correlated with film sound design, foley can be used nowadays even for standalone effects, in various sound productions. By creating a foley ‘stage’ in a small dedicated studio room and adopting the methods of film foley, many sound designers craft their own effects, from typical footsteps and clothes to crazy weapons and otherworldly creatures’ movement. The suggested requirements of the art are not exactly a children’s play, though, as mentioned in ‘The Foley Grail’: ‘Many people in our past and present are responsible with the development of an exciting and creative aspect of sound that requires sonic education, physical and mental discipline, and artistic creativity’ (Theme Ament)⁴⁴.

2.2.2. Design Plus A Few Other Words

Although the original role of Foley was to replace or enhance the footsteps of the characters and perform a few hand props, today’s Foley art contains more specialized design in its execution.

The most common function of Foley is to support reality. When the effects are aimed towards this direction, the overall concern is fitting in. Thus, they have to be carefully synced, using the production playback while performing the sounds. Furthermore, since they need to enhance and not detract, they need to be subtle and ‘arranged’ thoughtfully. Therefore, not only should the artist be imitating the action as faithfully as possible, but the props would need to be chosen accordingly as well. However, in this situation, Foley can be used as a single effect or layered with another track of Foley or edited sound effects, where it would entail complementarity. Moreover, sometimes, two different sounds might have to be performed and recorded at the same time. Each of these situations requires specific decisions, that the Foley artist and the mixer have to deal with, together.

⁴⁴Theme Ament, V., op.cit., p.15

When Foley's role is more specific, such as to enhance only, it is usually when the effect works in 'marriage' with field recordings or library edits. In this case, the main task of the Foley effect itself is to give character to the final sound. For example, a body fall is commonly based on a generic heavy thump sound, obtained from one or two tracks of cut effects, layered with a performed foley sound, which corresponds to the situation: specific clothes, movement, size of the body etc. In the same perspective, Foley can also sweeten a universal kind of sound, for instance, the sound of a car crash. The addition of small details in the sound offer identity, mood, particularity.

Moreover, when the vision exceeds pure realism, Foley takes the role of replacing reality. Bob Rutledge is famous to have been the first to comprehend and practice creating custom effects on the Foley stage. Experimentation and playfulness make this practice seem a lot like magic, bringing a fresh and personal touch to the sonic world of a movie, while also requesting time and money, quite rarely afforded to sound design in a film production. It works though extremely well within other media products, especially games, where there is no field recording per se, to be relied on in the first place. However, in this case, the emphasis goes less to the faithfulness concern, when thinking about how to design the Foley performance. Subtracting only a few elements from the visual cues, while adding extra elements, which belong more to the vision, might get the Foley artist started with his magic.

This practice is also relevant for when Foley is given a lot of freedom, especially in the more expensive and epic films. However, the role here is to create reality, and not just to replace it, so the artist is no longer expected to complement his special sounds with ones that are made to follow up the realistic moods. Therefore, he can decide a vision himself and proceed to creating without other boundaries than what he establishes. On the other hand, when there are less rules, there is space for more creativity, but also more risk of failure in obtaining connection and consistency within the overall sound, unless sound designers and Foley artists maintain some customized rules altogether.

Consequently, Foley stage can be considered a laboratory, the place where design is rooted in. Not much could be told through sound by using field recordings only, while mixing and matching would also not be efficient by always having to start

from scratch, with random ingredients. Therefore, Foley is important, if not the most important craft which helps building the bridge between art and design so far, the one supporting audio's powerful role within the wide and exciting media territory.

2.3. NOISY LIBRARIES

As mentioned in the beginning of the chapter, there is a third source for creating sound effects, one that has a lot to do with the need for automation discussed previously. Sound libraries represent collections of sounds, which, by providing sound designers of almost any professional orientation with 'prerecorded easy-to-use time-saving audio wonders' (Marks)⁴⁵, help maintaining freshness and creativity to their work.

Sound libraries are not as much about creation, as they are about iteration. One of their main attributes is that they save a lot of time and effort, by providing at least a foundation for various types of sounds needed in different productions. Sound designers can build their own libraries, from assets they have recorded or manipulated previously, but also have the alternative to use special collections, created and shared for fixed prices by larger scale providers. Purchasing these libraries does not grant ownership, but a license for using them in any kind of sound work.

While starting everything from scratch might be a challenging and productive task, it is very often not efficient at all, especially if the projects are not so much art oriented. Moreover, there are certain types of sound effects that are expensive to produce all in all, such as ambiances from certain parts of the globe, specific weapon and engine sounds, particular crowds, spaces, animals, and so on. Therefore, libraries prove to be cost efficient as well, truly gold mines in many situations. Although some of the most popular providers are 'Sound Ideas' and 'The Hollywood Edge', there are also various opportunities of purchasing single effects, online, which can work perfectly fine if the intention is to build a customized

⁴⁵Marks, Aaron. *The Complete Guide To Game Audio For Composers, Musicians, Sound Designers, And Game Developers*. 2nd ed. Focal Press, 2012. Print.

library or there is simply no need for more than one specific sound, according to the situation.

‘In actuality, most of the sound effects that end up in the sound library were at one time either field recordings or Foleyed effects. Glass clinks, gun clicks, background dishes, background cop gear, papers rustling, desks creaking, and other such sounds are background sound effects that were, at one time, performed as wild Foley on a stage by a Foley artist or sound editor’ (Theme Ament)⁴⁶.

2.4. NOT ABOUT FILM

Either based on Foley, field recordings or libraries, sound effects have been gaining popularity in many other disciplines and products than movies or radio. However, as discussed earlier, the roles they are undertaking within these different mediums are very similar to the ones that have been explored in film production, such as telling stories, complementing visual or mechanical elements, adding mood and so on. Therefore, the distinctions between sound effects’ usage in various fields become obvious on a rather practical level, when concepts such as behaviour or structure occur. The way they are used and not necessarily their purpose brings on further inquiries and ideas about how they should or rather would be created and handled.

2.4.1. Consistent versus Surprising. Games

While the film industry has found an important ally in sound design, with Foley as a cornerstone, other fields have been borrowing their example as well. The game industry is one of the most popular such grounds. Film-game convergence is already a familiar concept, suggesting that both territories influence each other, while targeting very similar purposes and audiences.

Among the most common elements they share are processes such as: 3D modeling, visual effects and physical simulation. Moreover, game audio has been more and more oriented towards a cinematic style, mainly to support one crucial aspect of

⁴⁶Theme Ament, op.cit., p.32

game design, immersion. Therefore, recording techniques, Foley-based effects, and even music have been developing within games, in constant connection with the film model. The emphasis on realism and technical quality determined game producers to encourage and invest in sample-based audio, while the collaboration with real orchestras has become just as common in major game productions as in film.

The divergence, however, filters in through the basic structural difference between the two: linearity. On one hand, film is linear and static, providing time for crafting every detail in a scene and perfecting the effects' physics with maximum precision: 'There's lots of place for direction and auteurism' ⁴⁷. Games, on the other hand, are nonlinear and dynamic. Interactivity plays a vital role, which places design on the same hierarchy level with craft, and often even higher. Thus, many times, elements that work perfectly within linear mediums might not work as efficiently within the non-linear ones, without requiring new approaches or compromising other important elements.

As many similarities there are between the two, designing sound for film and for games have, in fact, quite different meanings. When making decisions about audio elements within a movie, for instance, there is no relevance in considering behavior. The sound 'score' is projected left to right, from the design stage until playback. However, in games, audio has the responsibility to follow the dynamics of other elements, tracking various parameters in order to respond appropriately. Therefore, the concept of 'procedural sound' and 'procedural methods' has started to gain more and more interest during the past couple of years.

Although using linear sound for various assets in a game sustains consistency and convergence with cinema, it also compromises other important aspects of the workflow and eventually gameplay, such as implementation, speed, and, paradoxically, immersion: 'If the other big concept constantly bandied about in the industry is "Immersion", then there is nothing that will break that faster than repetition. I'd rather opt for a more consistently surprising experience than risk taking the player out of the moment' (Kastbauer)⁴⁸.

⁴⁷"Film / Game Convergence » *Filosofy.org*". *Filosofy.org*. Web. 21 Feb. 2017.

⁴⁸Kastbauer, Damian. "Audio Implementation Greats #8: Procedural Audio Now". *Designingsound.org*. N.p., 2010. Web. 16 Jan. 2017.

Randomness and variation are crucial in simulating reality and building dynamism. With static sound assets, implementation requires countless versions of the same sound effect, and often imaginative solutions for tricking players into believing the experience. The naturalness and surprise elements seem to matter more than the realistic, film-like style, in an interactive environment. Moreover, looking back at the beginnings of games, all the audio was created through synthesis, while immersion was supported by anything else than realistic sound quality: adaptiveness, mood, feedback speed, sync and accuracy and so on. The impact over audiences proved successful enough to provide inspiration for musicians, filmmakers and game designers even nowadays. Perhaps it wasn't necessarily due to the particular esthetics, but rather to the particular type of experience and the discrepancy between the obviously artificial content and the stability of the system itself, correlated with the intuitive and somehow natural interaction with the players.

Consequently, there is no question about the power of traditional methods of creating sound effects. Instead, there seems to be a perpetual misunderstanding concerning intrinsic values and specific functions of sound in a context, often neglected in favor of successful patterns. If the roles of SFX in linear contexts have been slightly overplayed, then there is certainly worth studying the requirements of these different mediums, experimenting and eventually subtracting alternatives.

2.4.2. SFX and Music

Not only did music influence sound design, but things have been working the other way around, as well. Along with the development of cartoon and foley, composers also found inspiration in the new techniques, starting experiments which assimilated recorded sound. The movement was called 'musique concrete', and incorporated 'any and all kinds of sound generation (acoustic, electronic, human, etc.) in the formal settings of concerts and studio recordings' (Sonnenschein)⁴⁹.

It was Pierre Schaeffer and his associates from the French radio system who pioneered musique concrete, in 1948. The concept relied on a montage of natural sounds, which had been previously recorded and processed freely, without restrictions of normal musical rules, like harmony, beat, melody, etc. Further on,

⁴⁹Sonnenschein, op.cit., p.58

composers such as Stockhausen and John Cage continued the experiments, using various devices which produced sounds (magnetic tape, morphophone, three-head tape recorder, etc.) but also recordings of musical instruments operated as sound effect generators. Under the generic nomenclature of 'extended techniques'⁵⁰, the strings family produced harmonics, screechy noises, vibrato, and different sounds resembling human voice, while the flutes simulated wind sounds and beat frequencies. Moreover, prepared pianos proved to be the home of endless creativity, providing unique sounds, like howling wind, thunder, eerie echoes and so on. Last but not least, infinite types of sounds would be obtained from just 'playing' different sizes, shapes and densities of many materials (metal, plastic, glass, wood) with percussive mallets, violin bows or compressed air.

However, the analog era hasn't necessarily been the peak of such practices in music. Digital cinemas and the newer big cinema productions have continued to inspire musicians even nowadays. Amon Tobin and Jocelyn Pook are only two of the most famous composers of modern music who use recorded material, more exactly sound effects, to create rhythms, textures and moods. Although their musical styles are extremely different, they have both contributed to film soundtracks in an original and valuable way, bridging the emotional role of music with strong referential hints subtracted from the world of realistic, organic sounds.

Although there are many examples of music composed for film, in which one or more sound effects are edited musically, as part of the score (for instance, the typewriter sound, in 'Atonement', 2007), it is even more interesting to hear standalone music, built from scratch, with sound effects only. Amon Tobin's work is innovative and inspiring. Famous mostly for his technique, which produces a powerful and original sound, his performances manage to gather impressive crowds. The principle of his way of making music is to transform any given source material into a new sound. Among the methods experimented throughout his albums, it is worth mentioning foley recording, manipulation of sounds through combinations of hardware and software, sampling and reordering instrument sounds from various genres into new patterns, technical sound design. Thus, his studio would very well resemble the studio of a sound designer. What differs, though, is the 'score', which replaces the film script with musical marks.

⁵⁰Sonnenschein, op.cit., p.59

3. ANIMATION

// The Where The What



3.1. WALK NO LINE. WHY ANIMATION

Although animations are referred to nowadays as animated movies, they have existed far before motion picture was born, under the name of animated images. Through different devices, people have been experimenting with the persistence of vision since 1650. However, it was only after the invention of the cinematograph, in 1894, that the possibilities of animation started being explored with deepened interest. Newspaper cartoonists were the ones who drew the first short animated films, referred to as ‘cartoons’, thus pioneering traditional animation, around 1900.

Therefore, the concept of synchronized sound reached animation at the same time it reached film: in 1928, the year when the first ‘talking picture’ (‘The Jazz Singer’) was released, Walt Disney Studios also produced the first animation with a synchronized soundtrack, ‘Steamboat Willie’. Although sound design evolved in parallel within movies and animations, an interesting separation occurred in the very beginning of the process, influencing the overall progress of the craft. Due to the fact that, in the 1920’s and 1930’s the recording equipment was too large and heavy, it would only be used in the studio. While the ‘soundmen’ of the time were expected to deliver sound effects that resembled natural sounds to fit the context of the filmed sequences, cartoons afforded more freedom for experimentation. The result became known as an ‘out of context’ style, which was basically ‘mickey mousing’, but with a twist. While the term refers to the dull function of sound in the beginning of cinema, which was to escort, faithfully, every action on the screen, the more meaningful side of cartoon sounds was that they were not particularly following the same content of the visuals.

Not only is animation the predecessor of motion picture, but it refers to a wider perspective than films as well. The fact that it is basically free of many restrictions that movies have is supported especially through its use in both linear and nonlinear contexts, while also proves to be supportive for creativity and experimentation within the sound design territory. The preceding example is not

only suggesting that sound design has found an ally in animation, but it is also revealing the fact that animation could continue offering a pertinent ground for further development. The next subchapters will discuss these points in more detail.

‘As a medium for sound design, you can’t beat animation. I’ve created countless robots and aliens. Built a career on animals practicing martial arts, transforming jet packs, spaceships and futuristic racers. I’ve traveled to the far end of the Galaxy and destroyed the known universe more than once (it turns out, there are a LOT of ways to go about destroying the world)’ (Jeff Shiffman)⁵¹.

3.1.1. The Fusion. All Linear and Sound Design

Although animation inspired the birth of film, it only developed under its influence, being researched in depth mostly in correlation with the cinema context. Thus, linearity has become its home, otherwise an attribute specific to film, and, along with it, has imposed its restrictions and luxuries as well. The sound design workflows have been mostly following the film audio production model, despite a few relevant variations, which will all be discussed in this chapter.

3.1.1.1. Out of Context. The Inception

The so-called cartoon sounds, almost forgotten in today’s animation production, are still iconic for their tragic-comic effect. A lot like the the artists who were drawing cartoons, the soundmen of the time complemented the scheme of transcendence from an apparent ludic style to rather serious or dramatic meanings.

The initial approach for animation sound was the simulation of sound effects through recording a musician’s orchestrated performance, and usually included percussion instruments such as timpani, cymbals, or wood blocks, and, nevertheless, trumpet glissandos and violins, especially played in pizzicato technique. These effects were mostly music cues, meant to announce a character’s entrance or misbehavior. The approach belonged to the Warner Bros cartoons, and was led by sound editor Carl Stalling. However, Tregoweth Brown was the one who

⁵¹Andersen, Asbjørn. "Sound Advice: The Key To Outstanding Animation Sound Design | A Sound Effect". *A Sound Effect*. N.p., 2015. Web. 23 Feb. 2017.

enhanced it, by adding out of context sounds from the studio's extensive library of live action movie set recordings. This particular style, which was introducing a character coming to an abrupt stop through a car skid sound, or covering a character zooming off screen through the sound of a plane flying by, became a hallmark of Warner Bros acoustic characteristic.

The second approach, though, is the one that patented the cartoony sound effects, as we know them today, and was brought in by Jimmy Macdonald, a sound expert at Disney. Due to his unusual background, as both drummer and trained engineer, he started creating his own devices, which became custom sound effects machines for the prop room. Moreover, he largely pioneered the creation of gadgets such as wind and rain machines, glass jug motors, bowed frog ribbits, all of them simulating natural world sounds, in surprising, creative ways.

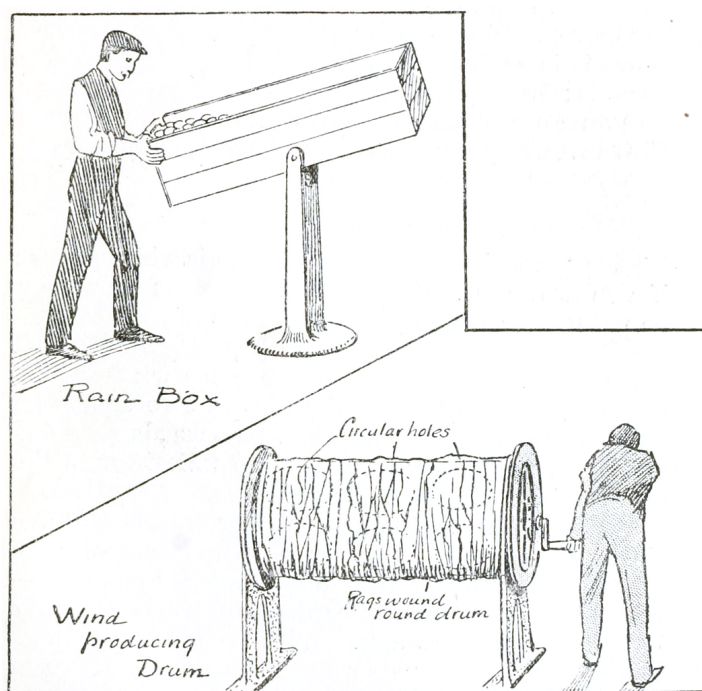


Fig. 10: Van Dyke Browne's drawings (*Secrets of Scene Painting and Stage Effects* , 1900)

'They were invented by a man whose whimsy and imagination, and whose skills as a musician, engineer and voice actor contributed to his playful and rhythmic perspective on sound' (Theme Ament 22)⁵².

⁵²Theme Ament, Vanessa. *The Foley Grail*. 1st ed. Hoboken: Taylor and Francis, 2014. Print.

Despite the fact that Jimmy was not exactly a Foley artist, he did mostly what animation Foley artists do nowadays, having changed, along with his inventions, the way the animation sounds were made. The shift from using mostly music and instrument based effects towards the ‘bings and boops’ and many other indescribable sounds’⁵³ which are recreated and used in animations even in the current times, has shaped a new animation sound approach and public perception.

Lastly, television animation brought more emphasis on dialogue rather than action. However, as the interest slid away from the slapstick comedy style, the sound effects had to be created in a way that would suit and enhance the vision. Thus, it was Greg Watson from Hanna Barbera who built innovative sound effects and gathered them within a new, consistent library. Therefore, animated series like ‘The Jetsons’, ‘The Yogi Bear Show’ and ‘The Flintstones’ remained the proof and representation of classic cartoon sound effects to the present day.

Animation sound design started its journey into existence context-free, tool-free and practice-free, thus quite independent and loud. The two approaches to sound design operated by Warner Bros, enhanced through Disney’s innovative visions and methods basically provided the ground for Hanna Barbera’s iconic library.

The ‘out of context’ particularity of animation sound has made a clear statement, through communicating upfront something obvious for both the makers and the consumers: sound design in a linear context was meant to deceive. Accepting the deceit in animation, however, was far easier than in film, because animation itself was already perceived as deceit. Therefore, it has been spared the extra struggle to cover for a ‘lie’, and, at the same time, it has been given the freedom to actually talk. The illusion was generated mostly through the synchronized playback of visuals and sound, but neither the instruments, nor the recorded effects were, in any way, expected to come out of an animated, hand drawn picture. Therefore, the ‘Mickey Mousing’ term, used nowadays to describe a dull sound design and attributed to film, has, paradoxically, rarely been encountered in animation. A context added to another context would always generate a meaning, as long as the two contexts are perceived as such.

⁵³Theme Ament, op.cit., 22

Consequently, studying the beginnings and especially the connection with film sound design reveals, this interesting and valuable fact, which makes animation stand out as a medium for creativity and development of sound.

3.1.1.2. Workflows

The linearity attribute that animated movies share with film determines similar principles in sound design workflows. Therefore, connection with the script and edited visuals is mandatory. The most common way for a sound designer to approach the project is, first, to talk with the clients or producers, understand their vision and requirements and take relevant notes, which he would then share with the rest of the sound team. After everything has been cleared out externally, the priority is to establish a schedule that allows time for inventivity and experimentation for the team.

The first stage of actual work is called principal editorial and represents the phase when the sound editors build a library of sound effects needed in the timeline. The process comprises various actions and techniques, which serve the purpose of creating each and every sound, according to the notes and decisions discussed beforehand. These include recording of props, manipulating, layering and even using synthesis, if or when necessary.

‘The less we rely on existing library materials, the more original a show will sound over the course of time’ (Jeff Shiffman)⁵⁴.

The next stage consists of assembling the sounds into a corresponding track. After a preview of the visuals in sync with the sound effects, together with the rest of the team and clients, dialogue and music are added in. Ultimately, the mixing stage concludes the flow and comprises fine tuning and preparing the soundtrack for the final view and approval.

However, unlike the sound workflow for movies, the field recording is never an option in animation sound, since there is no real field recording involved in production. Therefore, the source material is choice-free. It can be recording of

⁵⁴Andersen, op.cit.

props, in a studio, and, in this case, gathering the props might also be included in the schedule, even if sometimes or many times it might seem more like play than work. Moreover, the effects can be sourced in a library of previous recordings, which can be reprocessed and layered together with new recordings. 'Almost everything we build ends up in layers. It's very rare that a single sound effect works well on its own and building a moment by layering different effects gives us another chance to make something new' (Jeff Shiffman)⁵⁵.

Last but not least, sound designers can also call on synthesis for starting out a sound effect. Software synths, such as Sunrizer, are common tools in a sound studio, because they are affordable, inspiring and very DAW friendly, in contrast with the analog ones, saving time, effort, and, obviously, money. For animations, synth based sounds can be extremely valuable, especially when the projects involve strange galaxies, robots, aliens and other imaginable and unimaginable creatures.

Apart from sound effects and their sources, one other element which separates film from animation in matters of sound design is the treatment of dialogue. Although it is usually recorded and edited largely within the same parameters as the dialogue for movies, prioritizing intelligibility, there are many cases, in animation, where, due to the characters' unusual identities or contexts, voices are processed further or 'sweetened' with effects. The processing might include filtering, gating, vocoding, pitching, doubling, feeding through convolution reverbs, and so on.

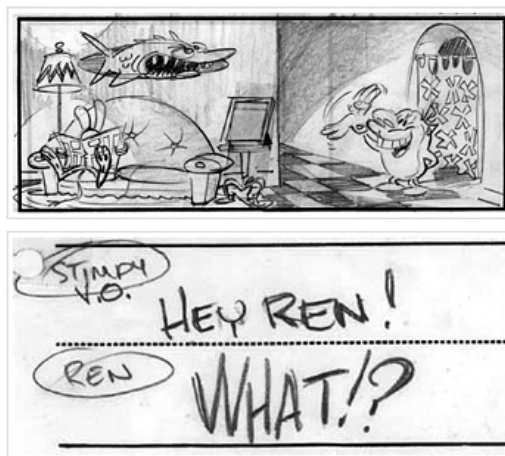


Fig. 10: John K's storyboard for the Ren & Stimpy episode "Stimpy's Invention."

⁵⁵Andersen, op.cit.

All in all, though, animated movies are timeline dependent and, in a certain amount, quite grounded to their linear nature, which has, nevertheless, its own advantages and delicacies: 'This is where sound design starts to feel like composing. There's a rhythm established here by the video editor, which we are then tasked to support and embellish' (Jeff Shiffman)⁵⁶. As stated previously, the image guide and the consistency of the actions supported by the sound provide enough time for working on details and even 'scoring' some sequences in creative ways, with the opportunity of perfect sync.

3.1.2. A Nonlinear Home

'Animation infuses the characters with life, and makes them feel like real living and breathing people. More than just the basic walk, run, attack and jump animations are implemented into the game. Up close facial animation is required, and subtle character traits you would see in animated movies are now being put into video games' (Masters)⁵⁷.

The evolution of digital arts has brought a new perspective on animation, providing it with a different home to develop and grow, in a nonlinear way. Although ruled by the same basic principles introduced by Disney animators - squash and stretch, anticipation, staging, straight ahead and pose to pose, follow through and overlapping action, slow-out and slow-in, arcs, secondary action, timing, exaggeration, solid drawing, appeal⁵⁸- animation is approached differently in games than in movies. The next subchapter will study the similarities and divergences between the two environments, with an emphasis on the way the nonlinearity attribute of games influences animation.

⁵⁶Andersen, op.cit.

⁵⁷Masters, Mark. "From The 80S To Now: The Evolution Of Animation In Video Games". *Pluralsight.com*. N.p., 2014. Web. 1 Mar. 2017.

⁵⁸Hopkins, Shawn. "12 Principles Of Animation In Game Development - Software Hamilton". *Software Hamilton*. N.p., 2013. Web. 16 Feb. 2017.

3.1.2.1. Game Animation

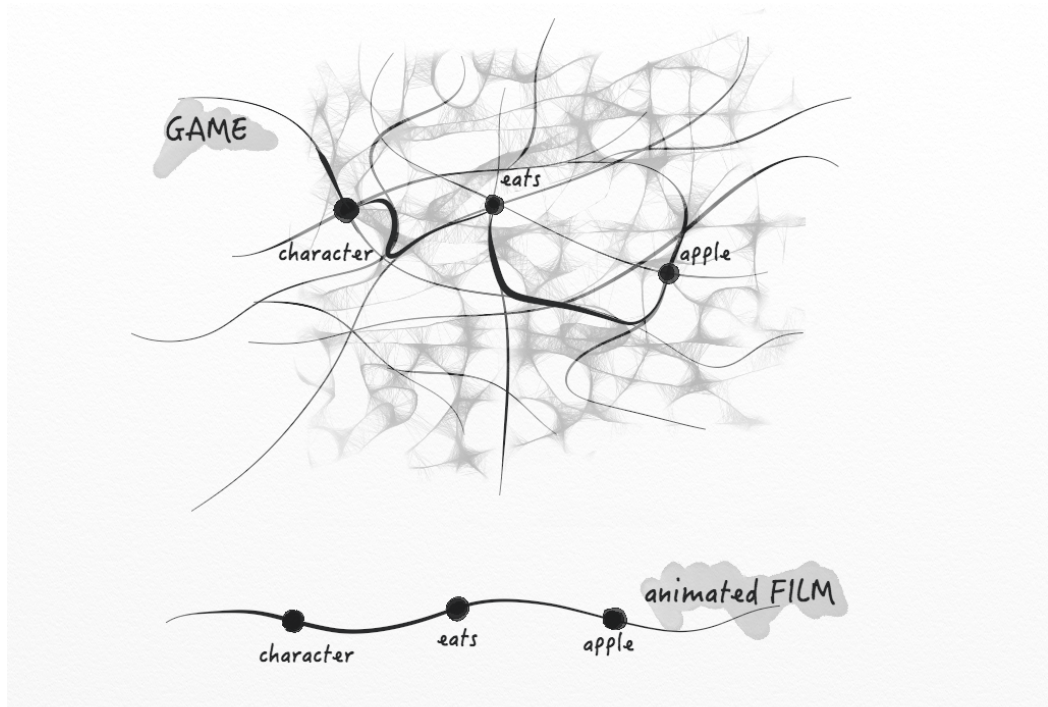
Animation has had a crucial role in games ever since their beginnings, representing a leading element in making the experience believable and, thus, maintaining the interest of the player. Moreover, by adopting animation from the linear context of movies, games have also taken for granted most if not all the developments which had occurred in animation during its evolution, including styles and techniques.

Therefore, it is seamless to notice that the tools and principles apply to both the nonlinear and the linear medium. What is more, in their attempts to pursue better methods of storytelling to engage the players, many games have been using linear animation within Full Motion Video cut-scenes (FMV), which are basically animated clips and don't differ in any special way from movies.

On the other hand, as mentioned previously, there are relevant distinctions between the two approaches, mostly visible in the case of in-game engine animations. While the FMV sequences are generated almost the same way that the content for film or video is produced, with minor or no user input, being utilised for narrative purposes only, the in-engine animations tell the story of the character through body-language and limited graphics. Thus, the main distinction between games and film becomes obvious at this level and lies in the different goals that the two mediums have: on one hand, a film's major purpose is to serve a narrative, while a game's major purpose is 'to serve the game play, so the game player can create his own story' (Sam Yip)⁵⁹.

Therefore, the genre restrictions start building up from the demand to prioritize the emphasis on characters' personalities through animation: body movements like running, walking, swinging a sword, as well as idle gestures, need to be cycled, so that they look believable and can be transitioned any time the player decides for the character to take action. These shifts need to be smooth in order to preserve the illusion, thus influencing the way some basic animation principles are handled.

⁵⁹Garabedian, Mark. "Video Game Animation". *Animationarena.com*. Web. 12 Feb. 2017.



Since the purpose of the present work is not the exploration of animation in detail, but rather showing its potential as a medium for development of sound effects, by studying its approach in different environments, the principles mentioned at the beginning of chapter 3.1.2 will not be described. However, in order to exemplify the previous statement, i will refer to the anticipation principle, which is the most transparent for the case specified above. Anticipation is one of the main rules of animation and it has to do with a character's gestures of preparation for a movement. Due to the timeline and storyboard that the animator can use in film or television, the process is quite seamless within the linear animation workflows, whereas in games, considering a good balance between 'instantaneous character response and believable movement' (Garabedian)⁶⁰ becomes a key element and requires the animator's priority focus. Moreover, the technological limitations, such as an engine's frame rate, will usually demand for compromise. Therefore, if the animator prioritizes believability to technical perfection, he would have to find creative solutions, in order to make the anticipation animation meet its purpose even within less frames, when the engine's frame rate is low.

⁶⁰Garabedian, op.cit.

In a similar way, the other principles of animation apply in games, always with consideration to the gameplay first, and usually requiring creative planning. ‘Game animation isn’t about creating top-notch performances like in *Frozen*, but about ensuring the animation will work well for the player’ (Masters)⁶¹.

3.1.2.2. Sound Contexts. A Reflection on Games, Animation and Sound

Game audio can easily be referred to as the sound for the animations used in a game and, therefore, closely connected with them in the general perception. However, animations should not be confused with the game itself. Since linearity is no longer the dictator of laws, both sound and visuals have to obey the game play and conform with the player’s decisions. Therefore, sound design in games is not limited to the particular animations, but, in a similar way as the animations, it depends on behaviors and parameters determined by the game design. When it comes to its role in building and supporting the experience represented by a game, sound is an individual element, situated on the same level as animation. At the same time, though, a considerable amount of its design includes, nevertheless, fitting in and syncing with the visuals.

Thus, due to the inherent connection with the animations, the sound design of a game shares a lot of similarities with the sound design for an animated movie. According to the purpose of this research, though, the current subchapter will focus mostly on the differences between the two.

A major distinction between approaching audio in games and animations is revealed through the way the trade is organized. While movies have developed a very compartmented workflow, using a variety of related specialists, such as sound recordist, Foley artist, sound editor and sound designer, in games, the term ‘sound designer’ incorporates all of the previously mentioned tasks in one. The reasons why this is happening rely mainly on the tweaks applied to these traditional, film derived methods, from the necessity to meet interactivity requirements.

⁶¹Masters, Mark. "How Animation For Games Is Different From Animation For Movies". *Pluralsight.com*. N.p., 2014. Web. 16 Jan. 2017.

For instance, just like in animation, Foley owns a significant role in the process of creating sound effects for games. However, the Foley work for movies is handled differently. Due to the linearity of the story and the lead purpose of adding believable sound touches to the on-screen character movements, Foley represents almost a performance, driven by one or more people who are manipulating a set of props, in a specific order, to match the scene's action and sync with it. 'After a couple rounds of practice and a sound check, it's recorded and sent out to be dubbed into the project. It's always entertaining to watch these guys at work - shuffling around, manipulating various objects, and tossing things around in concert'. The result of Foley, in this case, is a recording of multiple sounds describing a complex operation.

Games, on the other hand, often require these sounds separately, so that they can be tracked by parameters in the game, and, thus, match the visuals and the game play at the same time. It is not only an established sequence, but a dynamic one that they need to cover. Therefore, someone who is doing Foley for game audio only needs to record the sounds individually, without a pressure of performing the entire scene. Afterwards, these recordings are edited and synced accordingly. Some of them might need to loop, until the action develops further, some might need to repeat at specific points, the same way that animations themselves are triggered within games. Unlike in linear contexts, both animations and sound effects have behaviors, which are generated by the game play and designed before the actual sounds or visuals are created. A simple example would be a character walking, slipping and eventually falling. The walking cycle would loop until reaching the place within the game level where the ground is slippery. At this point, from the audio point of view, the footsteps would stop, and the sound of body fall would be triggered, along with, probably, a vocal exclamation. Finally, there could be a mixture of objects rattling and vanishing slowly, as the action produced by the character's slip would come to a rest. 'Doing this kind of sound work for an animation file would utilize the same concept, but with a different delivery method' (Marks 272)⁶².

⁶²Marks, Aaron. *The Complete Guide To Game Audio For Composers, Musicians, Sound Designers, And Game Developers*. 2nd ed. Focal Press, 2012. Print.

Just like animations and films, games need background ambience sounds as well. Due to the fact that the timing of a scene is usually unknown, depending on the player's decisions, these atmospheres need special handling too, in comparison with the ones created for use within linear contexts. Therefore, the ambience track for an animated movie is created almost like a painting, by adding individual sounds here and there, on top of one or more stereo recordings belonging to the connected surroundings. The similar track associated with a game scene environment, on the other hand, requires a slightly different thinking, first separating the sounds into two categories: continuous and random. In order to maintain the illusion of believable space for a long time, without risking to break the immersion through obvious repetition, the former group comprises sounds that are meant to loop, such as ventilation fans, conveyor belts, distant wind, and so on, while the second group is made up of shorter, more particular sounds, which are supposed to trigger randomly: footsteps, doors opening or closing, distant voices, etc. These two categories are meant to contain, thus, sounds with different behaviors, belonging to the same theme and played simultaneously.

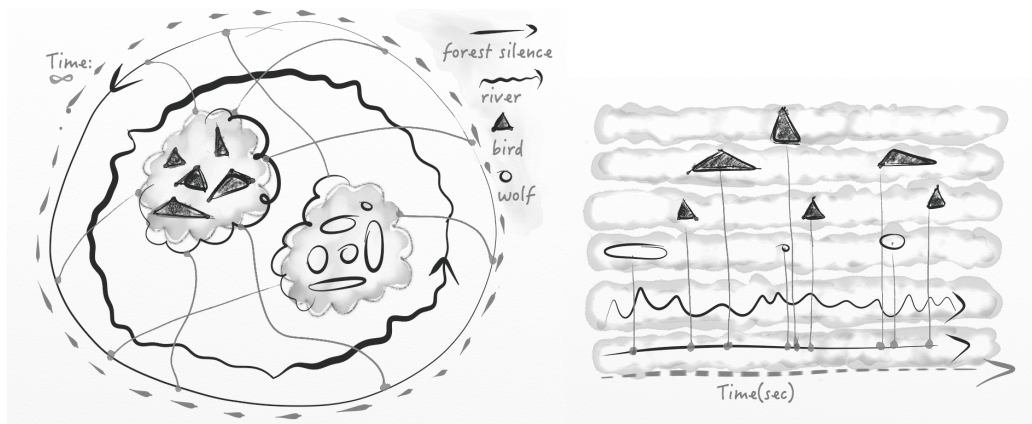


Fig. 11: Background ambience design in games versus animated films

Apart from several aspects that are treated almost identically in both linear and game animations, such as considerations for the audio design concerning genre and mood, enhancing dialogue, and so on, there are even more concepts that apply to both, but within slightly different perspectives. The emphasis of different sounds to punctuate a specific moment represents a common practice in both environments, but, for instance, games offer the choice of having a dynamic mix, whereas in animations, the artist will always build these effects, from the start, according to

their roles in the overall mix. The same principles can apply to background music, too. Since the moments of importance are unpredictable within game scenes, the music too benefits from a dynamic mix and even edit.

Moreover, there is a full palette of factors which determine further thinking when designing audio for games, in comparison with animations. Among the most obvious: the space assigned for sound and graphics, the inconsistency of playback systems, the type of platform the game will be released for and, nevertheless, the thorougher organization of files, influenced by the fact that a programmer will be the last and the most vital link in the chain, binding everything together, in the place of an editor, in the linear case.

While the same main types of audio sources apply in the process of creating sound effects for both games and animation, the necessity to avoid repetition and keep accurate response throughout changes that are not only time determined, has given birth to a completely new perspective on achieving and syncing audio material. Games have not only provided the circumstance to develop procedural methods for playing back sounds, but recently, also the chance for creating them, procedurally.

Although the topic has been discussed already in a previous chapter, the comparison between animations and games as contexts for sound creation shows a relevant and significant point of view over their connection: if most of the developments brought to sound design through film and animation have been borrowed and adapted for game audio, then it would make sense that animation, in turn, would somehow benefit from the audio innovations rooted in the games realm.

3.1.3. Animative

‘For expressing the imagination, animation is an especially useful medium because the creator is not limited by what can physically be staged in the real world’⁶³.

Either in games or movies, animation overtakes a unique responsibility and, at the same time, virtue: giving life to characters and ideas, by transforming the static into

⁶³"Imagination Animation - Literature And The Arts". *Hallumdickens.weebly.com*. Web. 24 Feb. 2017.

dynamic. It could represent the expression of everything imaginable, which might not be shared more accurately in any other shape.

There seem to be no boundaries for the most absurd thought within animation parameters. Proving to be a great preserver of illusions, including the most important of all the illusions in the human world, time, animation looks like the ideal field for experiments. If sound designers are told to be sorcerers, than there might not be a better collaboration than the one between the magic lantern and the audio ‘magicians’.

Having explored its versatility in both linear and nonlinear contexts, the research will proceed with a few particular cases where sound has been used in a rather eccentric manner compared to the current standard vision.

3.2. ANIMATION AND SYNTHESIS. (NOT) ALWAYS ABSTRACT

Looking back at the beginnings of animation, the very first approach to sound design was using musical instruments to produce sounds for different gestures or intentions of the characters. As described in a previous subchapter, the typical effects were created by using acoustic, mostly orchestral instruments and became iconic, as cartoony sounds. Later on, starting with the 1960’s, and reaching a peak in the 1980’s, this particular approach bloomed again, along with new perspectives on musical styles in film. Jazz music and even synthesized phrases started orchestrating sequences in animated movies. Especially with the rise of conceptual and art animation, in contrast with the cartoony or fairytale types, this approach gained attention and success. Probably the most mesmerizing such examples are ‘Fantastic Planet’(1973, Rene Laloux), with a soundtrack recorded and composed by French jazz pianist Alain Goraguer, ‘Son of the White Mare’ (1981, Marcell Jankovics) and ‘The Cosmic Eye’ (1986, Faith Hubley). The combination of musical sounds and Foley effects continued to hunt the world of animation until these days.

On the other hand, the beginnings of video games have shown a completely different perspective on sound design. The synthetic, artificial style, imposed by the

technical limitations and, at the same time, innovations of the 1980's has generated iconic sound effects and music, which have been referred to quite often within film productions as well, during the last couple of years. Although nowadays' games rely a lot on orchestral music and recorded sound effects themselves, having borrowed the cinematic style, little has been noticed the other way around.

Experiments with synthesized sounds have occurred mostly in European cartoon series and in short, abstract animations. The 1979 German TV series, 'Nick Knatterton', reveals the classic approach of musical sound effects all the way through the soundtrack, except the instruments are all replaced by analog synthesizers. Therefore, it could be considered an example of fusion between the first approach in animation sound and the first approach in game audio.

However, most of the previous research and experimentation with synthesized sound and animation, together, has been evolving around attempts to parallel the audio and visual realms.

'I think that it is possible to establish links between perceptual categories of synthetic sounds and abstract visual forms. This conviction has led me to consider different areas of application, chiefly through the creation of a new type of audiovisual work, based on the interaction between sounds and visual objects rather than music and images' (Abbado)⁶⁴.

The idea of visualizing sounds, but especially music, has seen, perhaps, the widest area of application, until now. Although quite particular, and oriented towards live music shows, VJ art is one realm where the correlation between audio and visual elements offers a good perspective on the possibilities that can be opened through marrying synthesized sound with animated images. Moreover, the rather abstract style used by this art has been recently developing into demo videos of stop-motion animation meant to fit certain electronic music pieces. One such example is Greg Barth's promotional video advertising the Belgian online electronic music platform 'Hello Play'.

⁶⁴Abbado, Adriano. "Perceptual Correspondences Of Abstract Animation And Synthetic Sound". *Leonardo. Supplemental Issue 1* (1988): 3. Web.

From the perspective of visualizing sound and music, research and experimentation has also been made towards the concept of 'animated sound'. From the 1940's methods of creating a 'sound track directly by placing graphic marks on the surface of the celluloid'(Graca)⁶⁵ to various recent DSP based adventures involving electronic sound or music and visual elements, not only music has been generating graphics, but graphics also have been generating sounds.

Both visualizing sound and sonifying graphics are merely examples for the direction that investigations and developments have been mostly going in matters of animation and synthesized sound. The obviously abstract vision of this combination might have been influenced by the connection between synthesis and artificialness. However, animation itself is, originally, a tool for deceiving perception. Therefore, it wouldn't be absurd at all to reflect over the idea that synthesized sounds could suit any type of animated movie just right.

3.3. PERHAPS PROCEDURAL

Animation has gone a long creative way since the Magic Lantern. Having switched between various methods and techniques, animated movies are now created almost entirely digitally, while immersion has been enhanced by the development of 3D graphics and tools, offering countless possibilities of expression through fusions between visual styles. Along with it, sound design too has taken an exciting journey, contributing to the animative spirit of experimentation and discovery, always so present within animated works. Thus, both animation and sound have been bringing concepts to life, by mastering, together, the illusion of dimensions such as space and time.

As showed in previous chapters, Foley has been the most emphasized creative tool in matters of sound effects and audio design, in general. There is an impressive number of titles where sound design has proven innovative and efficient in surprising ways, while using effects based on Foley and other skillfully processed recordings.

⁶⁵Graca, Marina Estela. "ABOUT ANIMATED SOUND - Norman McLaren'S Experiences With Synthetic Sound". (2003): n. pag. Print.

'The Triplets of Belleville', a 2003 French animated film, is just one of the earlier examples where the soundtrack supports the inventivity of the animation and unusualness of the characters exactly. With almost no dialogue, the storytelling relies on the indicative style of both the animation and sound design, turning the film into a charming experience: 'The Foley is never obtrusive or lifelike. It is like the animation - illustrative and whimsical' (Theme Ament)⁶⁶.



Fig. 12: *The Triplets of Belleville*

Moving past the powerful, cinematic Hollywood style, recent animations have started to show more and more personal approaches to Foley and audio design as well. Pixar and Disney's 'Inside Out' (2015) depicts the world inside a little girl's mind, personifying emotions and revealing complex neuropsychological processes in a beautifully metaphorical universe. The sound design keeps up with the challenge, in a highly creative way. One example of the experiments involved in creating the soundscape of this abstract, yet very accessible and playfully looking universe, is represented by the sounds of the memory orbs: Foley artists have filled glass balls with different levels of water, in order to obtain variations of the sounds for different kinds of memories, either new and strong or old and rather fragile⁶⁷.

⁶⁶Theme Ament, op.cit., p.23

⁶⁷Anderton, Ethan. "Learn More About Creating The Sound Of Inside Out". *Slashfilm*. N.p., 2015. Web. 18 Jan. 2017.

Last but not least, the sound of 'Little Prince' (2015) uses different techniques and experiments as well, enhancing the variation of visual styles used throughout the animation and complementing the contrasts between the almost mechanical everyday life world and the magical mood of the parable universe.

On the other hand, there seems to be an indisputable connection between animation styles and the dynamics of technological and social world contexts. Therefore, it would be fair to conclude that animation has been, at least, indirectly, the expression of generations and mindsets through time, thus, belonging to them. Since sound design has been following along, it is needless to say that its supporting role would and should convey with the present visions and fashions as well. Although, as shown in previous subchapters, music is probably the most faithful evidence of the present 'digital' generation's voice, this mark could benefit as well from more emphasis in matters of audio character within animated film.

'If computers can generate the imagery in animated movies like *Toy Story 3* and *Despicable Me*, why can't they also generate the sound effects to go with them? Adding sound effects to an animation is still no different to dubbing it onto filmed footage: someone has to record the sound of a glass smashing, say, or trudge through a tray of gravel to mimic footfalls, then sync the noise with the action'(Marks)⁶⁸.

Consequently, as efficient as it has proved over time, Foley art might also benefit from passing some tasks over to artificial intelligence. Moreover, if procedural sound generation has found roots and ground in game audio, there would be no reason why it wouldn't work at least as well in animation too. Considering all the similarities between the two fields and the strong reputation of animation as a world of endless possibilities, even the least organic and 'believable' sounds obtained through procedural methods might be surprisingly suitable. As explained already, the procedures that have been used for creating audio effects until now rely on 'human touch'. Therefore, going digitally 'procedural' would be only one step away.

⁶⁸Marks, Paul. "Perfecting Synthetic Sounds For Animated Worlds". *New Scientist*. N.p., 2010. Web. 22 Jan. 2017.

4. NORMAL-ION

// My Reflection



4.1. A CONCEPT

The research has built up to a few points, which I want to propose as premises for further inquiries and experimentation. Either linear or not, animation could benefit highly from a different approach to generating sound effects. I chose animation, because it proves to be a relevant example of ground for experimentation with sound, which fits both territories. Therefore, it is easy to show that borrowing methods from game animation, such as, in the case I am discussing, procedural sound, could and should make sense to animated films as well. Moreover, the lowered importance of ‘realism’ when thinking about sound within animation represents an important reason to consider synthesized sounds a great alternative to Foley-based effects. Thus, from a rather creative point of view, they could be a valuable source of character, through their implicit artificial quality.

In addition, sound itself has affirmed to own a strong animative potential, especially and mostly in games, where the lack of safety boundaries, derived from linearity, has actually allowed for extra creativity. Last but not least, a person who creates sound effects is not just a craftsman, but very often a designer and an artist at the same time. Thus, the idea of industrialization is just as viable within the craft, as it is within the design and should not deprive one of the creative input. Any industry needs tools, and, as described within a previous chapter, the ‘real’, mechanical ones have already been invented, used, and partially abandoned, hence the virtual ones are those which this thesis focuses on.

All these ideas being revised, I would like to present the concept I called ‘Normal-Ion’, which is meant to illustrate my perspective, and, therefore, could be considered a tool of reflection before anything else.

The idea originally shaped along with my interest in the possibility of generating soundtracks, by mapping visual elements to audio elements, which would be

handled by a system. The idea of syncing visuals and sound in real time, skipping the audio editing stage, has been investigated through two previous projects, which I will describe in a later subchapter.

However, Normal-Ion is an animated cycle, depicting a sketchy character ‘being himself’. As the name is translated through ‘Average Joe’, the micro-animation is meant to comprise a few simple gestures in a random slice of Average Joe’s ‘life’. This animated section of a situation will loop for 1-3 minutes, resulting in a short, continuous animated film. The concept is very much inspired from the animation loops found in games, where the players are not supposed to be aware of the actual loop, therefore are tricked to believe in their interaction with continuous action. By drawing this kind of loop into a timeline, my aim is to show that there could be many benefits to linear animations if they borrowed techniques used within games, particularly from the audio point of view.

4.2. GENERATIVE SOUNDTRACKS

Yet, before proceeding towards a more detailed description of the aspects mentioned above, I will reveal the background of this idea within my work, through two different experiments around the thought of independent and infinite soundtrack for video.

4.2.1. The RGB Voicing Project

Or How Would a Video Sing If Given That Chance

A few years ago, inspired by VJ art, I became interested in testing whether visuals too could generate music. Therefore, by flipping the frame, I came up with ‘The RGB Voicing Project’.

Based in Supercollider, the project generates partially procedural music for any given video, in real time. The ‘RGB’ in the name refers to the fact that the Red, Green and Blue average values from the video clip are triggering different processes within the audio patch, consequently building the soundtrack, frame by frame. Moreover, the length of the video conditions the presence of the percussive sounds. The video parameters are, thus, calculated within Quartz Composer, which

communicates with Supercollider through osc messages. The result consists of an experimental music-like piece, which sounds subtly different with each video.

While working on its design, I was, coincidentally, also involved in a short animation project, hence looking for inspiration and props for that purpose. 'Hearts Forest' became, thus, the first clip to test my patch, before its own sound design was even started. At this point I actually realized that the generative system I was working on had a great potential to spur ideas and hints in almost any sound design approach, which would include visuals. In consequence, I decided that 'The RGB Voicing Project' had met its purpose in being a useful designer's tool rather than an art installation.

Although the outcome of the project is slightly far fetched from something that I would call music, the relevance as a soundtrack generator has proved quite right. Despite the fact that the connection with the visuals is quite abstract, most of the people who have tried it out expressed positive feedback on the way that it 'fits'. Of course, this particular example was meant to create a soundtrack, and not necessarily sound design, therefore, the audio palette is quite limited and the structure resembles a musical score rather than a film script.

Nevertheless, generative and procedural methods of creating sound confirmed to work within a fixed visual edit featuring a storyline. From this finding towards the purpose of the present research there would only be a few more steps to take.

4.2.2. With-In. An Installation

With-In is an audio-visual installation, which has been exhibited in Seoul in June, 2016. While the main goal is experiencing happiness in an interpassive way, the piece invites people to sit in front of a projection and contemplate within themselves, in the guidance of visuals and music.

The project is thus meant to replace an abstract concept with an experience. Moreover, it is not interactive, but interpassive, as we called it, inspired by Slavoj Žižek's quote: 'By way of surrendering my innermost content, including my dreams and anxieties, to the Other, a space opens up in which I am free to breathe: when

the Other laughs for me, I am free to take a rest; when the Other is sacrificed instead of me, I am free to go on living with the awareness that I have paid for my guilt, and so on.’(Žižek)⁶⁹

Which means that, although the public cannot change anything in the story, the immersion relies on surprise and mood, therefore the world we created through the installation had to feel alive, to have its own wills and rules, away from immediate perception. Consequently, we chose randomness and infinite loops, revealing an apparently linear story, which would build and rebuild itself in real time, endlessly. Thus, we gathered almost twenty clips, each consisting of one video snapshot, corresponding to one type of happiness (out of five), and let them play randomly in a continuous sequence. In other words, we designed a montage of a film which would basically edit itself at playback.

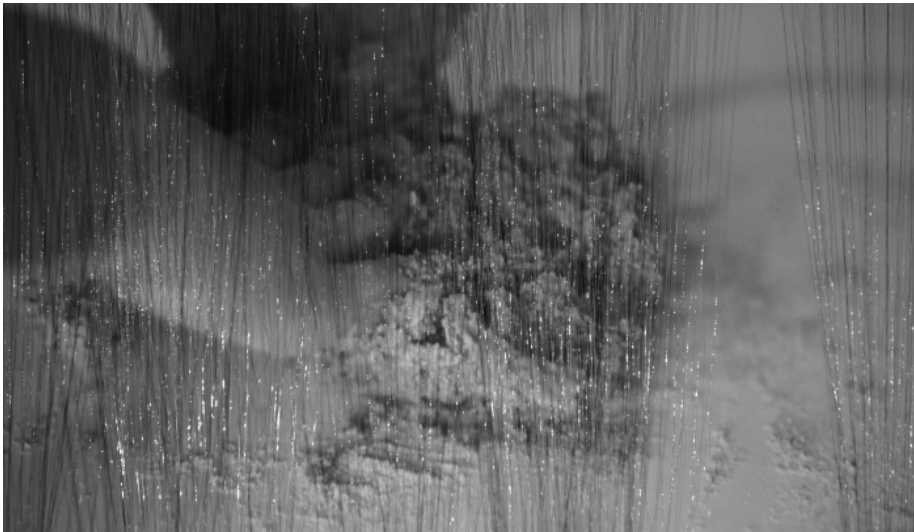


Fig.13: *With-In*

In spite of its linear representation, the narrative thread cannot be grasped, therefore anticipation doesn't work. The person who experiences the installation has to be *There and Then*, which is also why I decided that the soundtrack should follow the same principles as the visual sequence. Since the audio unity of the whole 'film' was an important consideration, in order to keep the experience together

⁶⁹Žižek, Slavoj. *The Interpassive Subject*. 1998. article. *Traverses*.

within the illusion of ‘linearity’, my approach was to create the soundtrack in a vertical manner.

Consequently, I designed it by imagining a number of audio layers (seven, in the end), each of a different character (one or more instruments, ambience, samples etc) and belonging to one of the five types of ‘happiness moods’ considered for the video clips as well. For avoiding repetition, there was a set of two to five loops for each layer, hence the soundtrack would be ‘selected’ randomly for every clip, each time it would play. However, there were more than five audio layers, thus all of them were shared in a specific way between the five types of videos, in order to maintain the illusion of continuity between the clips and within the overall experience. Moreover, the transitions from a video to another carried a set of similar sound effects, designed accordingly to patch the eventual playback inconsistencies.

The soundtrack turned out rather musical. All the loops consisted of separate sound files, from either natural or virtual sources, edited and processed in a DAW, and then programmed into a generative ‘composition’ in Open Frameworks.

Later on, while trying to edit a linear sample of the soundtrack, in order to have a simple audio demo, I noticed it was rather difficult, if not even impossible, to simulate the composition. The generative system I had designed within Open Frameworks was dealing with a lot of hard work, while my attempt to do the linear edit manually lead to a merely satisfying result.

My conclusion, therefore, was that, with a few esthetic principles coded within a logical system, I could have my ideas brought to life with more precision and less effort than otherwise. In addition, although within this work there were no such particular requirements, I was surprised to notice that, in most of the cases, the soundtrack synced perfectly with the action on the screen. Consequently, even if the parameters which were shared with the visual elements were not extracted from the actual visual content, but from the five happiness ‘moods’, they were enough to make the two communicate with each other as well.

4.3. NORMAL-ION

Both these projects share the idea of a generative soundtrack, but none of them goes too far beyond music or into action syncing. Despite this fact, they support the precede of my research and concept, through a few related findings and confirmations, such as the efficiency of using automation to connect visuals to audio, either directly or indirectly, the strength of artificial randomness within a creative (work)flow, the underestimation of loops and recurrence, the constructive character of synthesised sound and so on.

Nevertheless, Normal-Ion is an attempt to combine traditional and procedural sound design methods, in order to demonstrate that foley art does not necessarily have to depend on an actor-performer and that the esthetics of animation audio don't need to relate to film audio in order to be great. The way I have thought about making it all happen will be detailed within this chapter.

4.3.1. From Scratch. A Reflection on Technicality

As stated previously within this research, making sounds 'from scratch' involves a set of tricky steps and skills, even when 'scratch' refers to a couple of raw or props recordings. Due to the fact that even in these situations timing and planning are compelled, I decided to touch upon the making of sound effects not through the process of creation, but by the actual birth of a sound effect. Therefore, creating sound effects procedurally, through a system designed to generate them on the go, would obviously save a lot of time: days, weeks, perhaps months. The process of designing and developing that system, on the other hand, might take even more, at this point. Since procedural audio requires complex knowledge and skills, it can be very challenging from a technical point of view.

After a long and difficult dwell between my readings and several attempts to learn and apply DSP theory within C++ language, I came to the conclusion that my particular interest as a sound designer should be the design, and not necessarily the programming or engineering part. A designer's' main task is to prototype, as I understood from friends specializing in media and visual design, thus I decided to propose Supercollider as prototyping tool for the design of my procedural sound effects.

In other words, my concept is to design all the sound effects for ‘Normal-Ion’ within Supercollider and make them unravel, from scratch. Acknowledging these facts, my plan of a workflow would track four main steps, in the following order: design, creation, recording and re-sync.

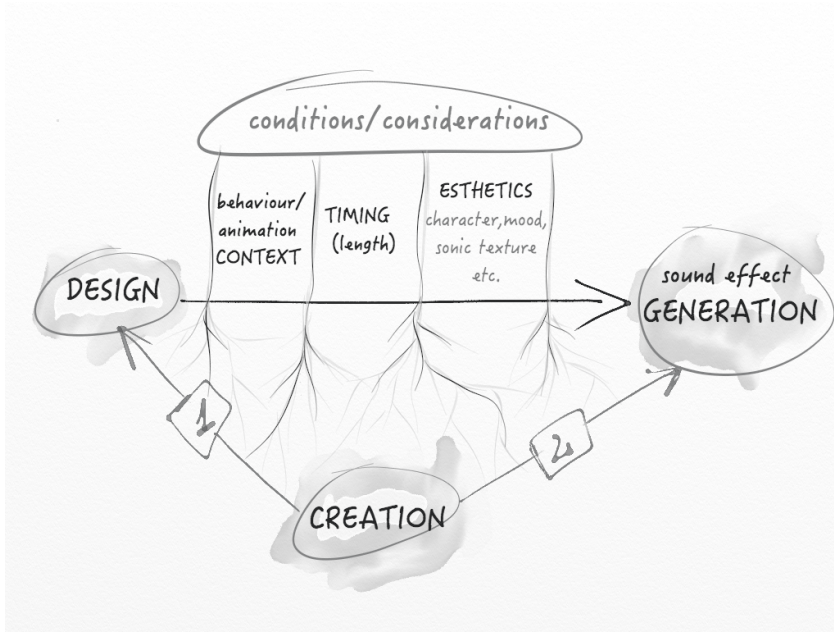


Fig.13: The diagram represents an attempt to describe my proposal for the creation process of sound effects, using procedural generation.

1. **Design:** building, for each sound effect, an algorithm which would generate the desired sound, every time it would be triggered, with slight variations; at this stage, it is important to decide the constant parameters, resulted from the timeline (animation) context: behavior or ‘shape’ of the sound effect, duration (according to the visuals, since they are supposed to be comprised of a linear edit), and esthetics (sonic character, mood, texture). These parameters I relate to the actual animation sound design, while the variations will occur due to parameters that don’t require control. Since I am not planning to use automated tracking of movement in order to generate the sounds, I am basically interested in sharing the work between the sound designer and ‘the machine’, using my algorithms to substitute the foley artist.
2. **Creation:** generating the sounds a.k.a. creating the sound effects, by triggering the algorithms which will produce my sounds.

3. **Recording:** recording and exporting sound files for each sound effect generated this way, from Supercollider into the DAW which will host the final edit.
4. **Re-sync:** placing the sound effects in timeline and eventually polishing the sync with the visuals.

4.3.2. Endlessly Animative. A Reflection on Functionality

Therefore, while the visual side of the animation would be a cycle looping several times, the audio would build around variations of the same sounds within each loop. In other words, the animation would repeat itself, but the sounds will be different. What I expect of the outcome is a continuous animation, which would stand as a whole, due to the dynamics of the audio.

The technique is quite common in game audio, where the necessity of visual loops calls for ingenious solutions from the sound design side. In that sense, fooling time is a skill and a task, which often falls straight within the main roles of audio. Nevertheless, many games still neglect this perspective and underuse sound, by treating it as nothing more than a mock-up for the linear, cinematic references. In the contrary cases, though, mostly encountered within the successful productions, sound variation is being achieved by creating enough versions of similar sound effects and programming them to play back in a random order, whenever the action calls for them. This method demands higher budgets as well, since every new version represents a distinct sound effect and, thus, requires more work. Fortunately, as mentioned previously within this thesis, the concept of procedural audio has been recently gaining more and more ground within game audio. Thus, procedural audio seems to be one of the most efficient solutions to fooling time, since its creation happens almost instantly.

In my project's case, the sequence of loops would seem quite static, due to the repetitiveness involved. Varying sound could, thus, resolve the seemingly automated character of the visuals, deceiving perception to believable continuity and liveliness. Because of their generative attribute and shared textures, the sound effects would work in a similar way with the soundtrack of 'With-In', described earlier.

In another perspective, the way I am picturing the functionality of the sounds in this instance is mirroring the hand-drawn animation process. If a character is meant to stand still, the artist will not reuse the exact same frame to cover the time of stillness, but will redo the drawing again and again, sparsely changing details of lines, for each and every frame. Therefore, creating the sound effects procedurally would comprise that, while the actions on the screen are static, the subtle differences in the sounds will animate the whole sequence.

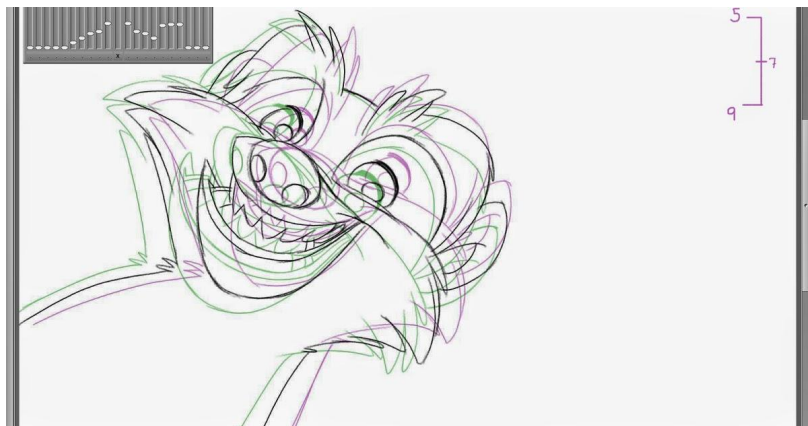


Fig.13: Inbetweening in traditional hand drawn animation

4.3.3. Endlessly Creative. A Reflection on Esthetics

From an esthetic point of view, perhaps the procedural creation of sound effects would disappoint some Hollywood sound fans. Letting go of patterns is usually the hypothesis and, at the same time, the result of creativity.

Looking back at my first attempt to illustrate an animation with sound effects, I realise it was before I had even tried to create any sound effect at all. The short animation had been downloaded from Youtube and it showed nothing more but a charcoal character dancing over a white background. The first thing I did was to tap the desk each time the character hit the ground from a high jump. Afterwards, I tapped the desk using two fingers, along with his dancing steps, while playing back the animation a couple of times. Next, I recorded these taps and edited them together on a track, and played them back together with the animation. I was amazed of how well the sync worked. However, the cuts between them sounded a little rough, even with fades. Therefore, I decided to record a separate track, where

I rubbed my hand against a hoodie, simulating the kind of movement that the character made with his body and hands. As silly as it felt, this last touch really made a difference. Moreover, everything just worked.

I wouldn't suppose that the result of my experiment sounded anything like the professional, realistic Hollywood style, but it was believable, and, in its clumsy way, quite organic and original. Giving a chance to procedural audio would basically spare the effort of finding props, performing and recording, not to mention maintaining or booking a Foley room. All these steps could thus be turned into design steps, while the outcome could be surprisingly nice, style wise.

An important notice would be the fact that synthesized effects don't necessarily translate into the old school, 'retro' game audio style. Although the richness and complexity of the sounds obtained from Foley recordings would be quite difficult to equate, procedural audio is a playground and I believe that there are many innovative solutions that could be achieved through giving it a chance.

The 'Normal-Ion' concept is yet an attempt to demonstrate that creativity can overcome the realistic sound 'paranoia' and release both animation and sound design from many of the filmic burdens, so much correlated with 'success'.

CONCLUSION



'Always being on the brink of the unknown and being prepared for the leap.[...] If through that leap you find something then it has a value which I don't think can be found in any other way'⁷⁰ (Steve Lacy, Herber, Collins 107)

In the attempt to understand what procedural audio is, initiated from my interest in game audio, I discovered an application which could connect the worlds of interactive and linear arts in a surprisingly creative way. With a background in film studies and a vivid interest in sound design for animation, I found myself constantly reaching connections with the animated film territories, during my venture into the topic. Therefore, my research question became an exploration aimed to determine whether procedural audio could be a better alternative for generating audio in animation.

While defining and exploring the applications of 'procedural audio', within the first chapter, I highlighted the importance of its association with game audio. Conclusively, its functionality within this realm has been one of the main factors which determined the development of tools and encouragement of practice.

Furthermore, acknowledging that sound effects represent the most elementary connection between all the sound related arts, I continued my research by describing them from a rather wide perspective. Hence, the second chapter emphasized the methods of creating and using sound effects within different mediums, in order to reveal the links with procedural methods and their potential of generating SFX.

Within the third chapter, the discussion went narrower, exploring sound effects in an ambivalent environment, animation. The special attributes which were examined here justify its great capability to support experiments with sound. Moreover, the esthetic impact of synthesized audio in this context was addressed, with positive prospects. Finally, the fact that both procedural and traditionally crafted audio have found a place within the same umbrella drove the conclusion

⁷⁰Herber, Norbert in: Collins, Karen. *From Pac-Man To Pop Music*. 1st ed. Ashgate, 2011. Print.

that methods of creating sound effects could be exchanged as well, between interactive and linear products.

The fourth chapter gathered the main findings into a concept, aiming to show how procedural audio could be used as main source for sound effects in an animation. Reaffirming the importance of sound design and its distinct role from that of a craftsman or an engineer, my proposal pursued three key points of view: technical, functional and esthetic. Consequently, the innovation would rely on the great animative potential of procedural audio and the opportunity of a rather genuine style.

In conclusion, I expect that my research has revealed a quest for ideas and not necessarily for answers. Despite its rather complicated, technical appearance, the topic of 'procedural audio' has a great artistic capacity and applicability. Therefore, my greatest hope is that this thesis would arouse more openness towards it and perhaps hearten interest and confidence from artists and designers to inquire collaborations for future development of tools.

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